SOIL SURVEY OF PERTH COUNTY

REPORT NO. 15 OF THE ONTARIO SOIL SURVEY

Ministry of Agriculture and Food

David Ramsay, Minister

Agriculture Canada

Research Branch

Direction générale de la recherche

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SOIL SURVEY OF PERTH COUNTY

BY

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EXPERIMENTAL FARMS SERVICE

AND

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ONTARIO AGRICULTURAL COLLEGE

GUELPH, ONTARIO

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For other Counties and
Districts Survey Information,
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Ontario Ministry of Agriculture and Food,
Main Floor,
801 Bay St.,
Toronto, Ontario
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PREFACE

The survey of Perth County was completed during the summer of 1946.

Other counties and districts surveyed and maps published are as follows:

1.	*Norfolk*	*Map only*
2.	*Elgin*	*Map only*
3.	*Kent*	*Map only*
4.	*Haldimand*	*Map only*
5.	*Welland*	*Map only*
6.	*Middlesex*	*Map only*
7.	*Carleton*	*Map and Report*
8.	*Parts of Northwestern Ontario*	*Map and Report*
9.	*Durham*	*Map and Report*
10.	*Prince Edward*	*Map and Report*
11.	*Essex*	*Map and Report*
12.	*Grenville*	*Map and Report*
13.	*Huron*	*Map and Report*
14.	*Dundas*	*Map and Report*

ACKNOWLEDGMENTS

The Canada Department of Mines and Technical Surveys, Surveys and Mapping Branch, supplied the base maps. The final copy of the Soil Map was prepared for lithographing by the Cartographic Section of the Division of Field Husbandry, Soils and Agricultural Engineering, Central Experimental Farm, Ottawa.

Helpful suggestions pertaining to classification and correlation, and assistance in critically reviewing the manuscript came from Dr. P. O. Ripley, Dr. A. Leahey, Dr. P. C. Stobbe, Canada Department of Agriculture.

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FIG. 1—Outline map of Ontario showing location of Perth County and other areas for which soil maps have been published.

Soil Survey of Perth County, Ontario

by

D. W. Hoffman *and* N. R. Richards*

INTRODUCTION

The survey of Perth County soils, initiated in 1936 by the Experimental Farms Service, Canada Department of Agriculture, and the Soils Department at the Ontario Agricultural College, was completed in 1946. This report and the enclosed map present the findings of the survey. The map is drawn on a scale of 1 inch to the mile and it indicates the distribution and extent of the various types which may differ in texture, structure, topography, drainage etc. The purpose of the report is to contribute to the knowledge of the land resources of Perth County by outlining and describing the soils and by classifying them in terms of present and potential agricultural use. It is hoped that such a soil inventory will be of value to those planning the agriculture of Perth County as well as to the farmers who use the land.

PART I

GENERAL DESCRIPTION OF AREA

Location and Area

Perth County is located in the central portion of southwestern Ontario. It lies between Wellington and Waterloo Counties on the east and Huron County on the west. To the south are Middlesex and Oxford Counties and Huron and Wellington Counties share the northern boundary. The City of Stratford, situated on the Avon River in the southeast section of the County, is 88 miles west of Toronto and 51 miles northeast of London.

The area of the County is approximately 840 square miles, or 537,600 acres (Eighth Census of Canada, 1941). Of this, approximately 515,500 acres is occupied farm land.

County Seat and Principal Towns

The City of Stratford is the County seat of Perth County with a population of 17,038† persons. Stratford was founded in 1832 and rose to its present position from humble beginnings. The city, an important furniture manufacturing centre, is also the home of many other industries, one of the most important being the Canadian National Railway workshops. The Stratford Normal School and the Agricultural Representative's office are also located in the city.

* Mr. R. A. Gross and Mr. P. M. Manchester assisted with the field work; the analytical work was done by Dr. A. L. Willis and Messrs. H. S. Ive; E. F. Bolton and D. W. Hoffman. Miss G. V. Palmer assisted with the drawing of maps, charts, etc.

† Census figures from 1941 Census.

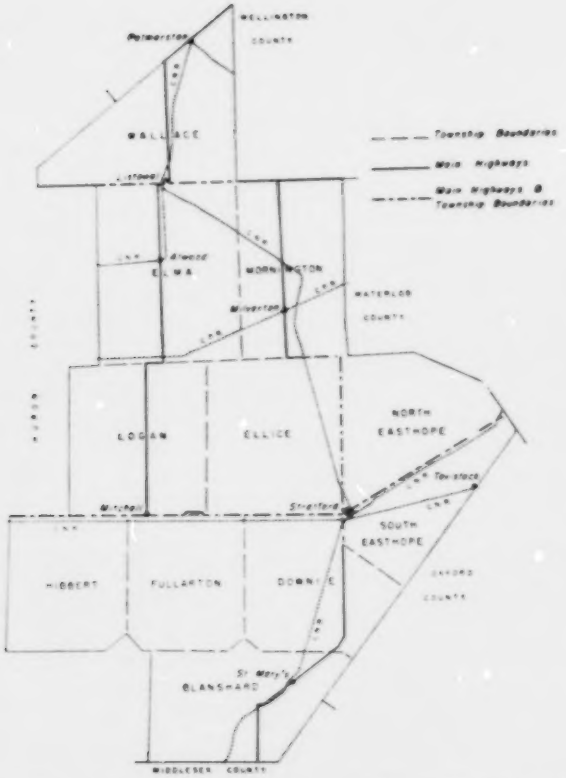


FIG. 2—Outline map of Perth County showing townships, towns, railways, etc.

St. Mary's (3,635) was founded in 1841 and is situated in Blanshard Township in the valley of the Thames River. The town has a fine industrial centre consisting of implement factories, flax mills and a foundry. The centre is also noted for its bedrock deposits that are utilized for building stone and lime. It is also a fine dairy centre.

A portion of Elma and Wallace Townships were incorporated as Listowel in 1866. The population now stands at 3,013. The town is a railroad centre and is noted for its furniture factory and other smaller industries.

Mitchell (1,777) was incorporated as a town in 1873 but the sale of lots took place in 1836 and the first building was erected in 1837. Mitchell is the site of one of the most modern creameries in Southwestern Ontario and is also noted for its flax mill.

Atwood, Milverton, Monkton, Dublin and Sebringville are other centres that provide local markets for farm produce.

Population and Racial Origin

The total population of Perth County as recorded by the 1941 census was

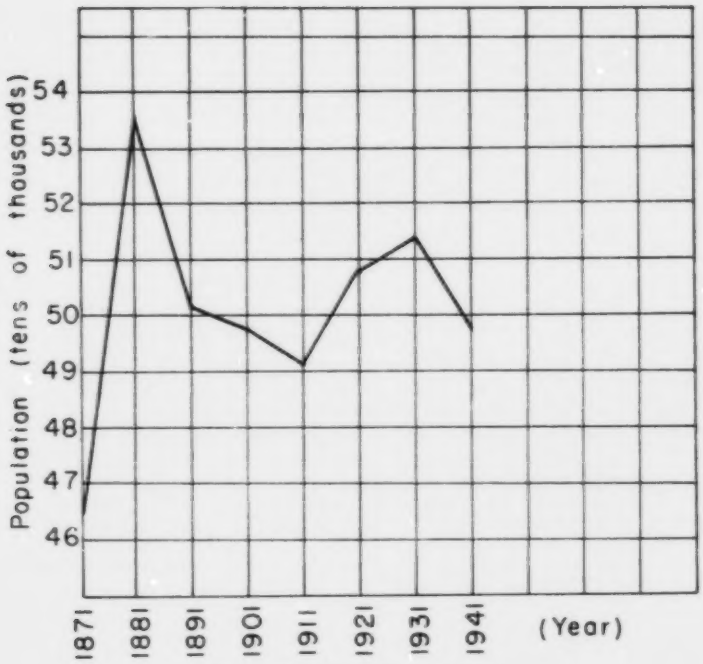


FIG. 3—The trend in population.

49,694 persons, 19,013 of these being on farms. The population of urban areas totals 27,114 leaving 3,567 persons as the rural non-farm population. As in other counties there has been a shift in population from rural to urban areas. The trend in population from 1881 to 1941 is shown in Fig. 3.

Although the population is dominantly of British origin, others are present. The following figures from the 1941 census indicate the origin of the people of Perth County.

Total Population	49,694	100%
British	35,267	70.8%
German	12,321	24.8%
French	1,069	2.2%
All Others	1,037	2.2%

Transportation and Markets

Good roads and railways act as connecting links between the more densely populated urban areas and the farming districts.

The County is well traversed with good gravel roads and paved highways. Highway No. 8 acts as the southern boundary line for Logan, Ellice and North Easthope Townships, and joins the centres of Mitchell, Stratford, Kitchener and Hamilton. Highway No. 23, running approximately north and south, connects Mitchell, Listowel and Palmerston. Running parallel to Highway No. 23 is Highway No. 19 which serves the eastern part of the County and

joins Stratford and Milverton. St. Mary's and Stratford are joined by Highway No. 7.

In addition to the main arteries mentioned above, there is a network of county highways and township roads that serve the whole County.

Both the Canadian National and Canadian Pacific Railway lines offer transportation facilities to the County. Stratford is a divisional point for the Canadian National Railway and various lines radiate from this centre. The line from Stratford to St. Mary's connects with the main London-Chicago line and it also connects Stratford with Toronto. Two other Canadian National lines leave Stratford. One goes west to Goderich and the other goes north to Listowel and Palmerston. Connections may also be had at Palmerston for Owen Sound or Toronto.

The Canadian Pacific line runs through the smaller centres of Perth County in Elma and Mornington Townships, connecting Monkton and Milverton with Goderich in the west and Elmira and Guelph in the east. The railway systems give good connections to all major centres and afford an opportunity for transporting farm produce to market.

PART II

FACTORS AFFECTING THE FORMATION OF PERTH COUNTY SOILS

The soil is a natural body found at the surface of the earth. Soils are formed through the action of climate and organisms on disintegrated rock particles which constitute the soil skeleton. Within a climatic zone differences in soil development occur due to local environmental factors such as soil parent material, drainage and differences in vegetation.

Soil Materials

Soils develop from geological deposits and their characteristics are influenced, to a large extent, by the nature of these deposits. Thus, geologic structure is an important factor concerning size and shape of particles and their arrangement. The structural types occuring in the area may be divided into two broad groups: (a) the unassorted tills laid down by glaciers, (b) the sorted materials laid down by water. The tills are further classified on the size and nature of the stones and the nature of the materials between them. The water-laid materials are subdivided on the basis of size of particles and on the type of layers or stratification. The size of the particle laid down is dependent on the speed with which the water was moving. Gravel and sand were deposited by swiftly moving water, whereas silt and clay were deposited in areas where ponding has occurred. It would appear that the soil materials of Perth County have been transported relatively short distances since many of the rock fragments exhibit characteristics similar to the underlying bedrock.

Perth County is underlain by the Norfolk limestone formation for the most part. However, in the northeastern section the underlying rock is of the Salina shale formation and the Bertie-Akron Series as shown in Figure 4.

The Norfolk formation consists of grey, brownish grey, and brown, crystalline to fine-grained limestone, magnesium limestone and dolomite in fairly even beds from a few inches to about four feet thick. Analyses* of the Perth County limestones are shown in Table I.

TABLE 1

BEDROCK ANALYSES

	Norfolk† Formation	Salina‡ Formation	Bertie-Akron Formation
Silica (SiO_2)	2.70	12.34	0.44
Ferric Oxide (Fe_2O_3)	0.47	0.41	0.14
Alumina (Al_2O_3)	0.81	3.93	0.16
Tri-calcium Phosphate ($Ca_3(PO_4)_2$)	0.15	.....	Tr.
Calcium Carbonate ($Ca\ Co_3$)	94.50	43.07	55.04
Magnesium Carbonate ($Mg\ Co_3$)	1.81	33.79	43.83
Total	100.44	93.54	99.60

* Goudge, M. F., Limestones of Canada. Their Occurrence and Characteristics Part IV Ontario, Canada Department of Mines and Resources; Bureau of Mines, No. 781.

† Quarry of St. Mary's Cement Company Ltd., St. Mary's.

‡ Analysis by Department of Mines, Ottawa.
Location of quarry at Lot 2, Concession VII, Brant Township, Bruce County.

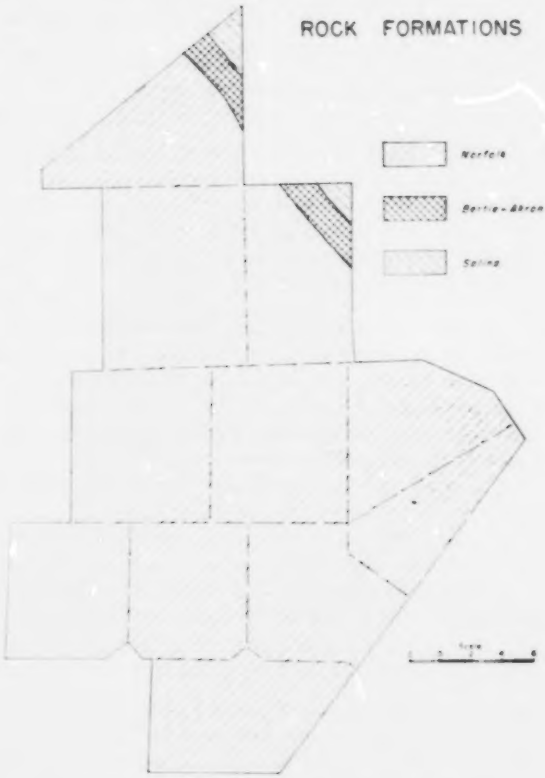


FIG. 4—Outline map of Perth County showing the rock formations.

Except for local areas (especially around St. Mary's where limestone bedrock of the Norfolk formation is exposed), the bedrock is covered with unconsolidated materials or drift. Most of this drift was laid down by the ice during the last or Wisconsin glaciation. Small areas of flood land along present stream courses, small areas resulting from wind and water deposition and larger areas of peat and muck are of most recent origin.

The surface deposits of soil materials in Perth County consist of:

1. Loamy limestone till
2. Subaqueous till
3. Glacio-fluvial deposits
4. Organic deposits

The relief and distribution of these deposits are shown in Fig. 5.

1. Loamy Limestone Till

The loamy limestone till materials are found in areas where the melting

ice has left deposits of considerable depth which have not been subsequently modified to any appreciable extent by water. Till deposits show a lack of sorting and stones, ranging in size from fine grit to large boulders, are scattered irregularly throughout the matrix of sand, silt and clay in varying proportions.

The limestone tills may differ in composition or in their physical characteristics as illustrated by the difference in colour of the Harriston silt loam and Guelph loam tills. The till in the Harriston silt loam is a buff colour and usually stonier than that of the Guelph loam. More complete descriptions can be found in Part III.

In general the limestone till plains are found in the northern and eastern parts of the County including Wallace Township and part of Elma and North Easthope Townships. Smaller areas are also located in southern and southwestern sections of the County. The till contains a large proportion of rock fragments derived from the Norfolk formation which is reflected in its calcareous nature. The topography of the limestone till plains varies from gently sloping to steeply sloping.

2. Subaqueous Till

The subaqueous till covers the largest area in Perth County. It is a continuation of the till found in Peel and Maryborough Townships in Wellington County, and is located in the Central section of Perth County including, Logan, Ellice, Fullarton, Downie, South Easthope and Mornington Townships.

Although the till is of limestone origin it has been modified by lacustrine waters. It is somewhat variable in composition and in some locations it is slightly varved indicating the presence of lacustrine materials. The texture is usually heavy and there is a much lower stone content than in the previously mentioned till. Although the topography varies from level to moderately sloping, most of the area has smooth gentle slopes.

3. Glacio-Fluvial Deposits

These are deposits of poorly sorted gravel, sand and till which occur chiefly in the Township of North Easthope.

The texture of the glacio-fluvial material is variable ranging from coarse sand to loam. The petrographic composition of the gravel and sand is similar to that of the till found in the area.

The topography is irregular steeply sloping and there are numerous glacial pot holes, which have no drainage other than down through the soil materials. The materials are porous, relatively deep, and lack uniformity in size of particles and sorting throughout their depth.

4. Organic Deposits

The humified remains of trees, herbs and mosses make up surface deposits referred to as organic material. These materials differ according to the source of plant material from which they were formed and according to the stage of decomposition. Areas where organic materials are fibrous and woody are called peat. Muck occurs where the organic materials are in an advanced stage of decomposition. No peat deposits occur in Perth County.

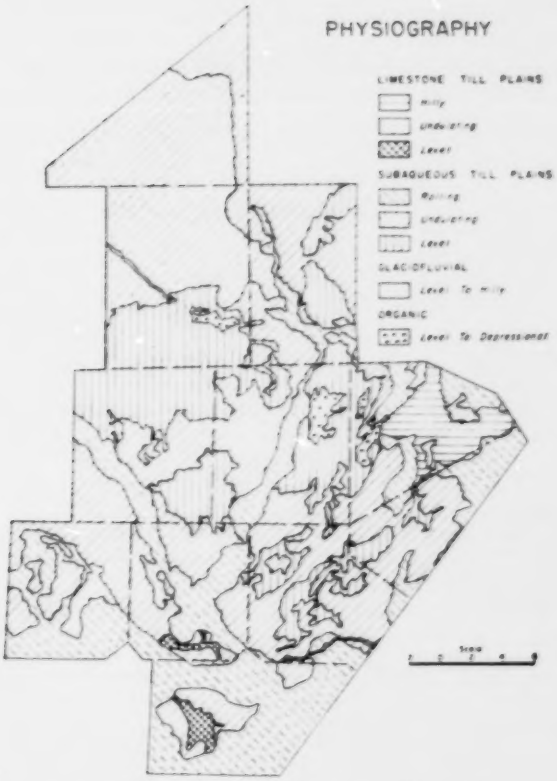


FIG. 5—Outline map of Perth County showing the physiography and soil materials.

Climate

Temperature and moisture exert a great influence on soil development. Both temperature and moisture have been found to affect soil properties such as reaction, depth of carbonates, etc. The amount of water and the rate at which it moves through the soil is reflected in the soil profile. The number and the distinctiveness of horizons and the depth of solum are closely related to the moisture relationship in the soil.

According to Putnam and Chapman* the chief factors which control the climate of any region are: (1) latitude, (2) altitude, (3) relief, (4) distribution of land and water, (5) proximity to the paths of cyclonic storms. Perth County is situated in one of the upland regions of Southern Ontario where the elevation rises over 1,300 feet. Putnam and Chapman have included the County in two climatic regions, the Western Uplands region and the South Slopes region. The Townships of Blanshard, South Easthope and part of Downie are included

* Putnam, D. F. and Chapman, L. J. — "The Climate of Southern Ontario." Sc. Agric. 18:8, April 1938.

in the South Slopes region, and the remainder of the County in the Western Uplands region. The reader is referred to Putnam and Chapman's paper, "The Climate of Southern Ontario," for a general description of these regions.

A meteorological station is situated at Stratford.

In view of the great influence of climate on the natural vegetation and on the agriculture of any region more detailed meteorological data are presented in Tables 2 and 3 for Stratford and these are compared with those from other areas in Ontario.

The data from Brantford represents the southern hardwood zone, Huntsville the transitional zone between hardwoods and conifers, and Kapuskasing the northern coniferous region. This difference in vegetation is due to the difference

TABLE 2

TEMPERATURE AT STRATFORD AND OTHER SELECTED POINTS

Month	Temperature in Degrees F.				
	Stratford (64)*	Mount Forest (23)	Brantford (51)	Huntsville (30)	Kapuskasing (19)
December	25	22	25	19	6
January	21	18	21	14	—2
February	20	16	19	12	2
Winter	22	19	22	15	2
March	29	27	30	24	14
April	42	39	43	39	31
May	54	52	55	52	46
Spring	42	39	43	38	30
June	64	62	64	61	57
July	69	67	69	66	62
August	67	65	67	64	60
Summer	67	65	67	64	60
September	61	58	60	57	51
October	48	46	48	45	39
November	36	34	36	32	22
Fall	48	47	48	45	37
ANNUAL	45	42	45	41	32
May 1 to Oct. 1	63	61	63	60	55

* Years observed

in climate, higher temperatures prevailing in the Brantford region. Data is presented from Stratford, located in the southern part of the County, to represent the climate of the part of Perth County included in the "South Slopes" regions. Mount Forest, which is located outside the area, was selected as the station where the weather data would most closely compare with that for the part of the County in the "Western Uplands" region.

As shown in Table 2 the difference in mean annual temperature between the station at Stratford and that at Mount Forest is not great. The winter temperatures of 15 to 22 degrees for Mount Forest are somewhat lower than the winter mean of 22 degrees for Stratford. Monthly mean temperatures for the part of the County located in the South Slopes region are slightly higher than those for the Western Uplands region. The frost free period for the part of the County located in the South Slopes region is from 136 to 142 days, while

TABLE 3

PRECIPITATION AT STRATFORD AND OTHER SELECTED POINTS

Month	Precipitation in Inches				
	Stratford (64)*	Mount Forest (23)	Brantford (51)	Huntsville (30)	Kapuskasing (19)
December	3.42	3.79	2.24	3.28	1.90
January	3.20	3.74	2.61	3.09	2.00
February	2.65	2.83	2.12	2.45	1.06
Winter	9.27	10.16	6.97	8.82	4.96
March	2.93	2.71	2.16	2.78	1.56
April	2.67	2.66	2.54	2.09	1.82
May	3.08	3.09	2.90	2.85	2.12
Spring	8.68	8.46	7.60	7.74	5.50
June	3.17	3.35	2.65	3.69	2.33
July	3.36	2.90	3.05	2.96	3.43
August	3.04	2.78	2.93	2.70	2.94
Summer	9.57	8.93	8.63	9.35	8.70
September	3.31	3.20	2.63	3.84	3.54
October	3.29	3.00	3.47	3.44	2.50
November	3.59	3.03	2.40	3.24	2.39
Fall	10.19	9.23	8.50	10.52	8.43
ANNUAL	37.71	36.78	30.70	36.41	27.59
May 1 to Oct. 1	15.96	15.32	14.16	16.04	14.36

* Years Observed.

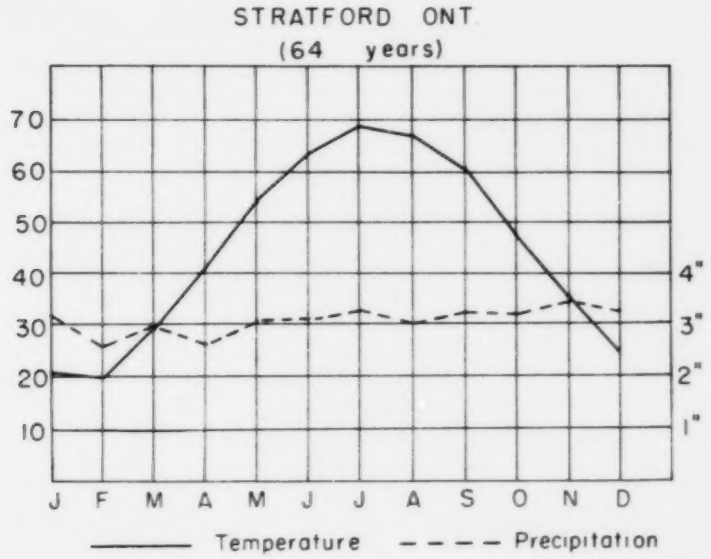


FIG. 6—Mean monthly temperature and precipitation.

that of the area in the Western Uplands region is 128 to 136 days. The South Slopes region has a growing season of 192 to 198 days, while that for the Western Uplands is 186 to 192 days.

The average annual precipitation at Stratford is 37.71 inches and at Mount Forest is 36.78 inches, while the mean precipitation during the growing season is 15.96 and 15.32 inches respectively. Precipitation is fairly well distributed throughout the year. Snowfall varies from 50 to 90 inches in the part of the County in the "South Slopes" region and from 70 to 100 inches in the "Western Uplands" region.

From the above data it would seem that the amount and distribution of rainfall is satisfactory for general farm crops. In general the climate of Perth County is characterized by cold snowy winters and warm summers. There is little likelihood of drought and the weather is usually favourable during harvesting season. The growing season is long enough so that a wide range of crops can be grown.

TABLE 4

CLIMATIC DIFFERENCES IN PERTH COUNTY

	South Slopes	Western Uplands
Mean Annual Precipitation	32 to 38 inches	32 to 38 inches
Mean Annual Temperature	43° to 45° F.	41° to 44° F.
Length of Growing Season	192 to 198 days	186 to 192 days
Frost Free Period	136 to 142 days	128 to 136 days
Snowfall	50 to 90 inches	70 to 100 inches

Snowfall may also be related to soil conditions. In regions where snowfall is heavy, spring cultivation may be retarded due to excess moisture in the soil.

A woodlot on imperfectly drained soils.

This excess water collecting on the surface occurs because of slow percolation due to heavy soil texture. In cases where runoff is rapid, due to a large amount of melting snow, severe erosion may occur.

Natural Vegetation

Once vegetative cover becomes established on soil materials it influences the type of soil formation that occurs. The vegetative cover varies with soil types that differ in texture, reaction, etc.

The soil survey of Perth County revealed that some combinations of trees occur more frequently on some soils than on others. No attempt was made to make a complete survey of the vegetation but sufficient data was obtained to indicate the distribution of the major tree associations on a generalized map (Fig. 7).

According to Halliday* Perth County is included in the Huron-Ontario section of the Great Lakes-St. Lawrence Region. In this region the prevailing association is broad-leaved with small groups of conifers included. Those associations most commonly occuring are:

1. Sugar Maple, Beech Association

This association is common to the medium textured well drained soils and therefore occurs chiefly in the northern part of the County where the Harriston series appears. Included with the association are basswood, ironwood, white ash and some oak. Occasionally white and red pine are found on the lighter soils.

* Halliday, W. E. D. — A Forest Classification for Canada. Bul. 89, Forest Service, Dept. of Mines and Resources, Ottawa.

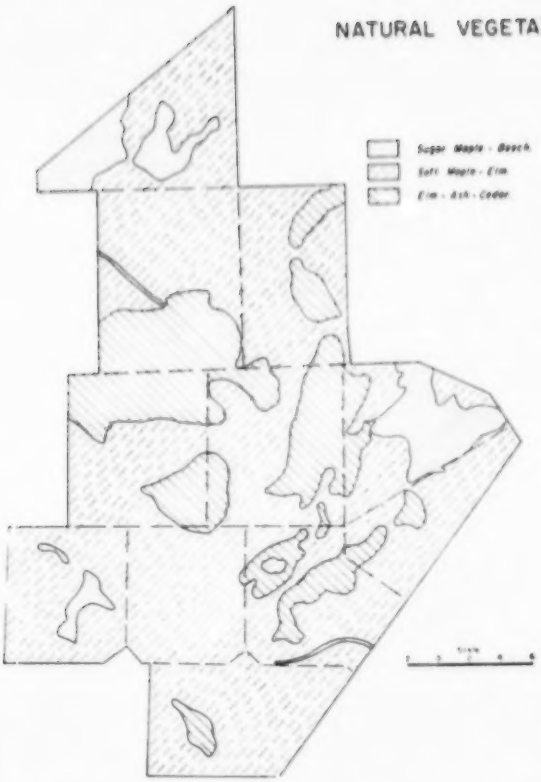


FIG. 7—Outline maps of Perth County showing the distribution of Tree Associations.

2. Soft Maple, Elm Association

Soft maple and elm are dominant on all the imperfectly drained soils and on the heavy textured well drained soils. Ash, ironwood and large-toothed aspen also occur in the association and sugar maple is present on the heavy textured, well drained Huron series.

3. Elm, Ash, Cedar Association

The poorly drained soils of Perth County support a vegetative cover of elm, ash and white cedar with a sprinkling of silver maple and blue beech.

Age

According to Antevs* the glacial lakes Warren and Whittlesey receded about 23,000 years ago. Therefore, the soils of the County have been weathering for that length of time. However, the influence of this weathering has been lessened in large areas of the County because of poor internal drainage. As reflected in the soil profile, these soils are much older than those of Eastern Ontario.

* Antevs, E. — Late Quarternary Upwarpings of North-eastern North America. Jour. of Geol., Vol. 47, 1939.

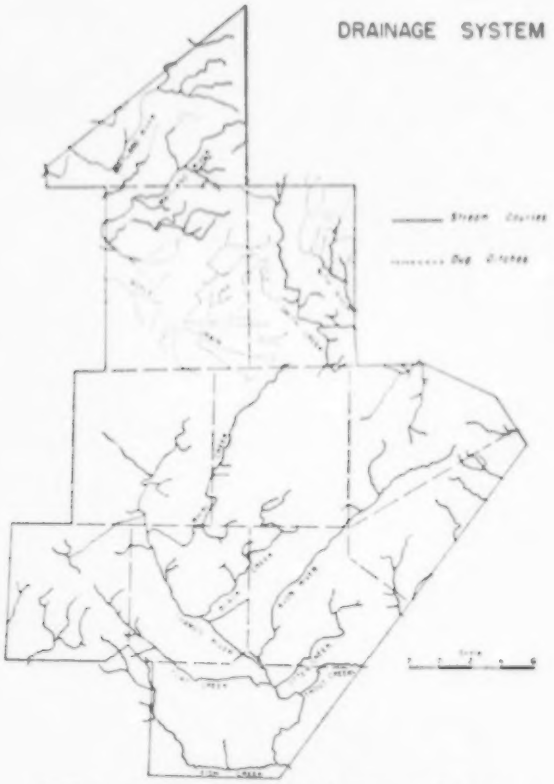


FIG. 8—Outline map of Perth County showing main drainage systems.

Relief

The relief of Perth County can be described as generally level to smooth gently sloping. With the exception of the moderately sloping areas which occur in Wallace, Blanshard and North Easthope Townships, and to a lesser extent in Hibbert and Fullarton Townships, the relief of the area is rather uninteresting. The level to smooth gently sloping till plains are broken by the occasional ridge and bog. Steeply sloping sand deposits occur in parts of North Easthope Township.

The altitude of the County ranges from 1,000 to 1,375 feet above sea level. The highest part is in the north-eastern section of Mornington Township from where the elevation falls in a southwesterly direction.

Drainage

The rivers and their tributaries draining Perth County are shown in Fig. 8. The southern section of the County is drained by the Thames River system. A small part of the eastern area is drained by the tributaries of the Grand River and the northern and western sections are drained by the Maitland River and its tributaries.

In spite of the fact that all but a portion of the central part of the County is served by numerous streams, over half the County area would respond to drainage improvement.

PART III

THE CLASSIFICATION AND DESCRIPTION OF PERTH COUNTY SOILS

Soils are the products of the environmental conditions under which they are developing. These conditions are governed by the effect of climate and vegetation over a period of time on parent materials under existing drainage conditions. During the process of formation different layers have developed in the soil which can be observed in a vertical cross section of the soil to a depth of about three feet. This cross section, including part of the underlying parent material, is generally referred to as the soil profile, and the individual layers are called the horizons of the profile. In Perth County the kind and number of horizons found in the soil profile and the sequence in which they occur vary greatly among the different soils.

Two distinct kinds of profile occur in the Perth County area. Each kind of profile represents what is called a Great Soil Group. Soils of the Grey-Brown Podzolic and the Dark Grey Gleisolic Great Soil Groups dominate in the County.

The Grey-Brown Podzolic soils have developed under well drained conditions from calcareous parent materials. In the development of Grey-Brown Podzolic soils the podzolization process has been dominant. This process has led to the depletion of bases, development of acidity, and the formation of eluvial A horizons and illuvial B horizons. Tree leaves and other organic debris collecting on the surface of the soil decompose to give a surface layer in which the organic matter is well incorporated with the mineral material. Weak acids generated in the organic material are moved downward by percolating water which attack the soil minerals removing soil cations. The weathering of the soil minerals causes a loss of the metallic cations, including iron and aluminum, but most of those of silica remain behind. Organic and inorganic colloids are dispersed and moved downward in the percolating waters. With the removal of iron compounds and other colouring materials a light gray or pale brown colour develops where leaching is most intense. This layer constitutes the A_2 horizon of the Grey-Brown Podzolic soil. The A_2 horizon, can usually be divided into A_{21} and A_{22} horizons.

Immediately below the A_2 horizon, iron and aluminum accumulate along with colloidal clay and colloidal organic matter. The layer formed is called the B horizon and is usually brown or dark brown in colour with a somewhat heavier texture than the A_2 horizon. The easily soluble carbonates of calcium, magnesium, etc., are removed from the A horizon and carried away in the

drainage waters. The following is a generalized profile description of a Grey-Brown Podzolic soil.

A_0 — Accumulated layer of partially decomposed litter from deciduous trees.

A_1 — Dark greyish brown to a very dark brown mineralized humus layer.

A_{21}— Dark yellow-brown layer.

A_{22}— Pale brown layer.

B_2 — Dark brown layer.

C — Light greyish brown calcareous parent material.

In the Grey-Brown Podzolic soils in Ontario a secondary Brown Podzolic or Podzol profile often occurs in the A_2 horizon of the Grey-Brown Podzolic profile. On the medium and heavy textured soils the secondary or superimposed profile exhibits the characteristics of the Brown Podzolic soils. The dark surface layer is underlain by a brown or yellowish brown friable subsoil which gradually fades in colour and overlies the B horizon of the Grey-Brown Podzolic profile. On the sands and sandy loams the superimposed profile is usually a Podzol. In the Podzol profile the dark surface layer is underlain by a grey leached layer which in turn is underlain by a brown or yellowish brown layer which fades in colour and rests on the B horizon of the Grey-Brown Podzolic profile. Usually it is only under virgin conditions that the secondary Podzol profile can be noted since the grey leached layer becomes incorporated with the dark surface layer upon cultivation.

A large proportion of the soils in the surveyed area have developed under poorly drained conditions. The poorly drained soils of Perth County are representative of the following Great Soil Groups: Dark Grey Gleisolic soils, Bog soils and Alluvial (young) soils.

The Dark Grey Gleisolic soils have a dark, friable, granular surface layer, generally 4 to 6 inches thick which is underlain by a mottled brownish grey subsoil that gradually grades into the parent material. In comparison to the well drained soils that have uniformly brownish or yellowish brown subsoils the poorly drained soils have rusty specks and streaks and bluish grey colours in the subsoil. The discoloration or mottling of the subsoil is one of the distinguishing features of poorly drained soils. The Dark Grey Gleisolic soils generally do not have a marked leached layer or layer of accumulation. The following is a generalized description of a Dark Grey Gleisolic soil.

A_0 — Accumulated layer of partially decomposed litter from deciduous trees.

A_1 — Dark grey to very dark grey mineralized layer.

G — Brownish grey mottled mineralized layer.

C — Greyish brown calcareous parent material.

The Bog soils consist of organic accumulation one to three feet and more in depth. They may differ according to the degree of decomposition of the organic materials from which the soils have developed. The well decomposed dark Bog soils are referred to as "Muck" and the poorly decomposed organic materials as "Peat." The Bog soils have formed under very poorly drained conditions and frequently occupy depressional areas which receive considerable seepage.

The Alluvial soils consist of recently deposited material which has not been in place long enough for definite soil horizons to develop. However, layers differing in texture as a result of periodic flooding, can frequently be observed in the profile of these young alluvial soils.

System of Classification

Soils are grouped into categories, which can be described and readily recognized, on the basis of their differentiating characteristics. Those categories commonly used in mapping soils are the series, type and phase.

A soil series is a group of soils formed from similar parent materials and having similar profiles but varying within a narrow range of texture, particularly in the surface soil. The series is given a geographical name usually that of some local feature commonly associated with the area where it was first recognized and mapped. A soil series consists of one or more types differentiated on the basis of texture.

The soil type is the principal unit of mapping and is the most specific of any of the units. A soil type name consists of a series name plus the textural class name determined from the texture of the A_1 horizon. The soil type includes a range of conditions because, with mapping done on the scale of one inch to the mile, it is a necessity to allow a reasonable amount of variability within the mappable units. The range of characteristics tolerated within a series is discussed under the description of the various series.

A phase is a subdivision of a soil type used to show variations from the normal in topography, stoniness and erosion. It has not been used in the mapping of Perth County.

Those soils developed on similar parent materials but differing in characteristics of the solum due to differences of relief or drainage are referred to as a "soil catena." In the following key the catenary relationship of the soils of Perth County is indicated.

KEY TO SOIL TYPES OF PERTH COUNTY

A. Soils developed on heavy textured subaqueous limestone till

	Map Symbol	Acreage	% of Total
(a) Well drained — Grey-Brown Podzolic Great Soil Group			
(1) Huron clay loam	Huc	88,100	16.3
(2) Huron silt loam	Hus	17,800	3.3
(b) Imperfectly drained — Grey-Brown Podzolic Great Soil Group			
(1) Perth clay loam	Pc	112,500	20.9
(2) Perth silt loam	Ps	49,900	9.3
(c) Poorly drained — Dark Grey Gleisolic Great Soil Group			
(1) Brookston clay loam	Bc	78,200	14.5
(2) Brookston silt loam	Bs	32,100	6.0

	Map Symbol	Acreage	% of Total
B. Soils developed on medium textured limestone till			
1. Till Composed of Grey Materials			
(a) Well drained — Grey-Brown Podzolic Great Soil Group			
(1) Guelph loam	Gl	2,600	0.5
(b) Imperfectly drained — Grey-Brown Podzolic Great Soil Group			
(1) London loam	Ll	100	0.02
(c) Poorly drained — Dark Grey Gleisolic Great Soil Group			
(1) Parkhill loam	Pl	12,300	2.3
2. Till Composed of Pale Yellow-Brown Materials			
(a) Well drained — Grey-Brown Podzolic Great Soil Group			
(1) Harriston silt loam	Hsi	33,400	6.2
(b) Imperfectly drained — Grey-Brown Podzolic Great Soil Group			
(1) Listowel silt loam	Lsi	59,900	11.1
C. Soils developed on outwash materials			
1. Well Sorted Gravelly Materials			
(a) Well drained — Grey-Brown Podzolic Great Soil Group			
(1) Burford loam	Bg	1,000	0.2
(b) Poorly drained — Dark Grey Gleisolic Great Soil Group			
(1) Gilford loam	Gil	500	0.1
2. Poorly Sorted Gravelly Materials			
(a) Well drained — Grey-Brown Podzolic Great Soil Group			
(1) Donnybrook sandy loam	Dsl	3,700	0.7
3. Poorly Sorted Sandy Materials			
(a) Well drained — Grey-Brown Podzolic Great Soil Group			
(1) Waterloo sandy loam	Wsl	2,900	0.5
D. Recent Alluvial Material			
(a) Variable drainage — Alluvial Great Soil Group			
(1) Bottom Land	B.L.	32,700	5.0
E. Organic Soils			
(a) Very poorly drained — Bog Great Soil Group			
(1) Muck	M	9,900	1.8

DISCUSSION OF SOILS

A. SOILS DEVELOPED ON HEAVY TEXTURED SUBAQUEOUS LIMESTONE TILL

The parent material of this group of soils is a heavy ground moraine which has been modified to some extent by marine waters and lacustrine deposition. The Huron catena, of which the Huron series is the well drained member, the Perth series the imperfectly drained member, and the Brookston series the

Huron clay loam exhibits the characteristics of the Grey-Brown Podzolic soils.

poorly drained member, has developed on these limestone materials intermixed with shale.

These soils are present in the central and southern portions of the County and occupy 70 per cent of the total land area of Perth County.

(*a*) ***Well Drained***

Huron clay loam (88,100 acres)

Huron silt loam (17,800 acres)

The Huron series exhibits the characteristics of the Grey-Brown Podzolic Great Soil Group and is most commonly found in the southern part of the County.

The following is a generalized profile description of Huron clay loam, examined under woodlot growth:

A_0 — Thin layer of partially decomposed leaves and woody material.

A_1 — 0–4 inches very dark brown (10 YR 2/2) clay loam; granular structure; friable consistency; few stones; pH — 6.9.

A_2 — 4–10 inches light yellowish brown (10 YR 6/4) clay loam: weak platy structure; friable consistency; usually stonefree; pH — 6.8.

B — 10–21 inches dark brown (10 YR 4/3) clay; coarse blocky structure; hard consistency; slightly stony; pH — 7.0.

C — Pale brown (10 YR 6/3) clay till; fragmental structure; hard consistency; few to frequent stones; calcareous; pH — 7.8.

The parent material consists of unassorted till. There are angular and slightly rounded stones scattered throughout the profile.

In some locations a grey or bleached A_{22} horizon may be present between the upper A1 and the B horizon. This horizon is slightly firm when dry, stonefree and is usually rather thin being approximately 2 inches to 3 inches thick.

The topography of the Huron series is smooth moderately sloping with slopes ranging from 6 to 9 per cent and erosion is moderate. Where the land has been dissected by stream courses the topography is steeply sloping and erosion is severe. The natural drainage is good with high surface runoff and moderate internal drainage. Present forested areas consist chiefly of small woodlots where the soft maple-elm association is dominant.

Agriculture

Originally supporting good stands of hardwood forest, most of the land is now cleared and used for agricultural purposes. General farming and dairying are the chief types of farming carried on. Good yields can be obtained from cereal grains, corn, hay, pasture and alfalfa. Where the organic matter has been depleted and crumb structure destroyed the soil is difficult to work. Tilth can be improved with the use of barnyard manure to increase the organic matter content. Since dairying is common, a good supply of barnyard manure is usually available to return to the soil. Clovers grow well and will help to maintain and replenish the organic matter supply as well as to add nitrogen. Potash and phosphorous are the main requirements of clovers and alfalfa. Applications of commercial fertilizer are necessary to maintain adequate fertility levels. The soil contains a good supply of lime, making its addition unnecessary.

The Huron soils are susceptible to erosion but soil losses can be controlled

A variety of crops can be grown on the well drained Huron series.

by cover crops and hay and pasture crops or by contour tillage and strip cropping where applicable.

(b) *Imperfectly Drained*

Perth clay loam (112,500 acres)
Perth silt loam (49,900 acres)

Although Perth soils are imperfectly drained the profile exhibits sufficient Grey-Brown Podzolic characteristics to be included with that group.

The following is a generalized profile description of Perth clay loam occurring under virgin conditions.

A_0 — Accumulated layer of partially decomposed litter from deciduous trees.

A_1 — 0–6 inches very dark grey (10 YR 3/1) clay loam; fine granular structure; friable consistency; occasional stones; pH — 6.9.

A_2 — 6–10 inches light yellowish brown (10 YR 6/4) clay loam; mottled; weak platy structure; friable consistency; pH — 6.8.

B — 10–17 inches dark brown (10 YR 4/3) clay; mottled coarse blocky structure; hard consistency when dry, plastic when wet; few stones; pH — 7.0.

C — Pale brown (10 YR 6/3) clay; fragmental structure; hard consistency when dry, plastic when wet; few to frequent stones; pH — 7.8.

The horizons are not as well developed in the imperfectly drained Perth clay loam.

The topography of the series is smooth gently sloping and erosion is slight. The soft maple-elm association comprises the dominant tree cover and favours the development of a soil in which the humus is well incorporated with the mineral portion. The natural drainage is imperfect. Some Huron and Brookston soils may be included, in the areas mapped as Perth, that are too small to show on the map the scale of which is one inch to the mile.

Agriculture

The Perth series supports many different types of farming including dairying, poultry raising, general farming and growing of specialized crops. The soils are well adapted to the growth of oats, hay and pasture and fairly well suited for such crops as barley, wheat, corn and clover. Certain specialized crops such as flax, peas and beans can be grown and will produce good yields.

Drainage improvement is sometimes necessary for satisfactory crop pro-

duction depending on the crop to be grown. However, depressional areas that exist in conjunction with the gentle slopes make such improvement difficult.

The chief fertility needs are organic matter and phosphate. Frequent additions of organic matter, in the form of manures, are required if the soils are to remain easily worked.

(c) *Poorly Drained*

Brookston clay loam (78,200 acres)

Brookston silt loam (52,100 acres)

The Brookston series is the poorly drained member of the Huron catena and exhibits the characteristics of the Dark Grey Gleisolic Great Soil Group.

The profile horizons are less distinct than those of the other members of the Huron catena as is illustrated in the following profile description.

A_0 — Accumulated layer of partially decomposed litter from deciduous and a few coniferous trees.

A_1 — 0–7 inches black (10 YR 2/1) clay loam; fine granular structure; friable consistency; stonefree; pH — 7.2.

G — 7–11 inches grey-brown (10 YR 5/2) clay loam; mottlings increase with depth; coarse blocky structure; stonefree; very hard consistency when dry, plastic when wet; pH — 7.2.

C — Pale brown (10 YR 6/3) clay; mottled; fragmental structure; hard consistency when dry, plastic when wet; few to frequent stones; calcareous; pH — 7.8.

There is usually a certain amount of grit and stones throughout the profile but in some areas the top 2 or 3 feet is stonefree. The topography is smooth very gently sloping and erosion presents no problem. The natural drainage is poor with very low surface runoff and very slow internal drainage. Elm, ash, and cedar are the dominant species found in the woodlots with a few silver maple also present.

Agriculture

General farming and beef raising are most commonly practiced on the Brookston soils. Under natural drainage conditions the soils are well adapted to the growing of timothy, pasture, oats and hay. When drainage is improved these soils are much more versatile and are suitable for the production of corn, wheat, clover, beans, canning crops and peas. Therefore, drainage improvement is usually a profitable investment when these soils occur in an area where the climate permits the growing of cash crops.

The drainage can be improved with the use of tile drains or open ditches. A tile drainage system has several advantages over drainage by open ditches.

Large open ditches provide outlets for tile on broad areas of nearly level land.

For example when tiles are properly installed, little cleaning or other maintenance is required; the land over the tile is available for crop production and the inconvenience of turning at the ditch when working the field is avoided; there is no ditch bank to serve as an area for the production of weed seed; the tile lines may be placed at closer intervals and so provide more complete drainage. However, there are two disadvantages of tile systems: (1) the initial cost and (2) their inability to carry excess water during periods of heavy rainfall. Water furrows can be run across the field at frequent intervals to remove the excess water during heavy rains, but these drains are usually closed by cultivation later in the season.

Inherently Brookston soils are well supplied with organic matter, fairly well supplied with potash and low in phosphate. Under a concentrated system of farming where rotations are short the maintenance of organic matter is of prime importance and additions of manure should be made frequently. Depending on the crop to be grown both potassic and phosphatic fertilizers may be necessary for satisfactory yields.

B. SOILS DEVELOPED ON MEDIUM TEXTURED LIMESTONE TILL

The medium textured limestone till materials of Perth County consist of two groups that are differentiated by colour, texture and stoniness. The grey materials are less stony than the pale yellow-brown materials. The presence of many soft stones in the pale yellow-brown materials gives rise to a more silty profile than is developed over the grey materials. Because of these differences two catenas developing from medium textured limestone till have been mapped in Perth County.

The Harriston catena developed on pale yellow-brown materials and con-

sists of the Harriston series as the well drained member, the Listowel series as the imperfectly drained member, and the Parkhill series as the poorly drained member. The Guelph catena developed on grey materials consists of the Guelph series as the well drained member, the London series as the imperfectly drained member and the Parkhill series as the poorly drained member. Since the poorly drained members of each catena appear to be closely related both have been mapped under the same name, Parkhill.

1. Till Composed of Grey Materials

(a) Well Drained

Guelph loam (2,600 acres)

Guelph loam exhibits the characteristics of the Grey-Brown Podzolic Great Soil Group and is found in small areas in the southern part of the County.

The characteristics of Guelph loam are illustrated in the following profile description.

A_0 — Accumulated layer of partially decomposed litter from deciduous trees.

A_1 — 0–4 inches dark greyish brown (10 YR 4/2) loam; fine granular structure; friable consistency; slightly stony; pH — 6.9.

A_{21}— 4–12 inches pale brown (10 YR 6/3) loam; fine platy structure; very friable consistency; slightly stony; pH — 6.8.

A_{22}— 12–14 inches grey (10 YR 6/1) loam; fine platy structure; friable consistency; stonefree; pH—6.6.

B — 14–24 inches brown (10 YR 5/3) clay loam; medium nuciform structure; hard consistency; few to frequent stones; pH — 7.0.

C — Light grey (10 YR 7/2) loam till; medium nuciform structure; hard consistency; moderately stony; boulders vary from few to frequent; calcareous; pH — 7.8.

The relief consists of smooth moderate slopes and erosion is moderate. External drainage is good and internal drainage is moderate. Present forested areas consist of small woodlots in which the sugar maple-beech association is dominant.

Agriculture

A large proportion of the soil is cleared and used for agricultural pruposes, general farming and dairying being most common. The soil is well adapted to small grains, turnips, alfalfa, red clover and hay and is fairly well suited to tree fruits, potatoes, corn, and canning crops.

Guelph loam is inherently low to very low in phosphate and is only moderately well supplied with organic matter and potash. Additions of fertilizers high in phosphate, nitrogen and potash are required for most crops if good yields are to be maintained.

Susceptibility to erosion is a hazard to crop production and can be most easily prevented through the use of long rotations and cover crops. However, the long smooth slopes make it possible to use contour tillage, strip crops and other special methods to prevent soil loss.

(b) *Imperfectly Drained*

London loam (100 acres)

One of the minor series mapped in Perth County, London exhibits the characteristics of the Grey-Brown Podzolic Great Soil Group.

A description follows which shows the characteristics of a London loam profile.

A_0 — Accumulated layer of partially decomposed litter from deciduous trees.

A_1 — 0–5 inches dark greyish brown (10 YR 4/2) loam; fine granular structure; friable consistency; few stones; pH — 6.8.

A_2 — 5–9 inches yellowish brown (10 YR 5/4) loam; mottled; fine platy structure; friable consistency; few stones; pH — 6.7.

B — 9–12 inches brown (10 YR 5/3) clay loam; mottled; medium nuciform structure; hard consistency; few to frequent stones; pH — 7.0.

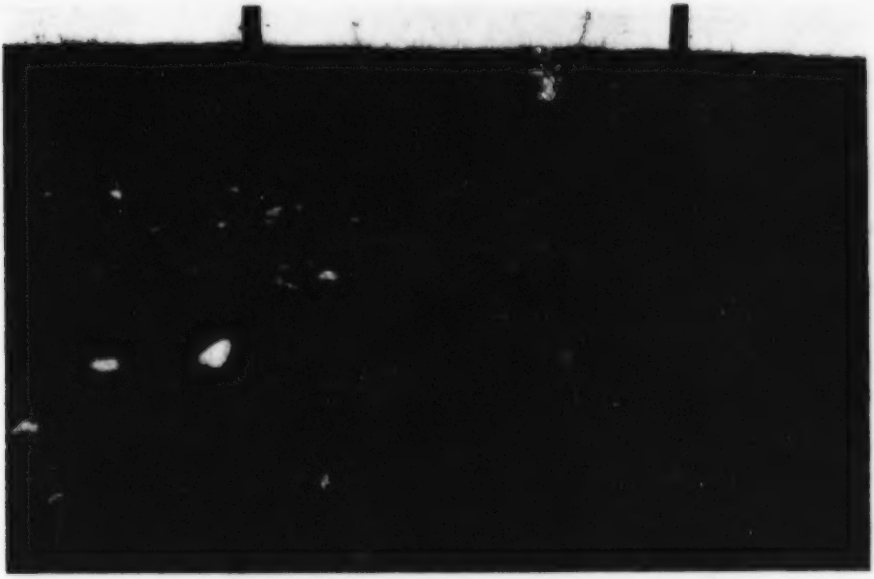
C — Light grey (10 YR 7/2) loam till composed chiefly of dolomitic limestone; medium nuciform structure; hard consistency; moderately stony; mottled; calcareous; pH — 7.8.

In some cases the A_2 and B horizons are so poorly defined that it is difficult to distinguish them. A few scattered stones and boulders may appear on the surface. The topography is smooth gently sloping and erosion is slight. The natural drainage is imperfect having low runoff and slow internal drainage. The natural vegetation in the remaining woodlots consists mainly of soft maple and elm but ash, beech and a few balsam also occur.

Agriculture

The London series is fairly well adapted to the growing of oats, barley, turnips, red clover, hay and pasture and is chiefly used for general farming.

The chief fertility needs are organic matter and phosphorus. Organic matter can be supplied through additions of barnyard manure and phosphatic



Stones occur in fairly large numbers in the medium textured till.

fertilizers should be used to provide the phosphorus needed by the plant. Drainage improvement is sometimes necessary for satisfactory crop production depending on the crop to be grown. Boulders may appear in the upper portions of the soil profile which will interfere with cultivation or with the placing of drains.

(c) *Poorly Drained*

Parkhill loam (12,300 acres)

The Parkhill series is the poorly drained member of both the Guelph and Harriston catenas and exhibits the characteristics of the Dark Grey Gleisolic Great Soil Group. Other than a sharp colour contrast between the dark surface and drab grey lower layers the horizons in the profile are poorly defined. The following is a description of a Parkhill loam profile.

A_0 — Accumulated layer of partially decomposed litter from dominantly deciduous trees.

A_1 — 0–6 inches very dark grey (10 YR 3/1) loam; fine granular structure; friable consistency; pH — 7.0.

G — 6–14 inches grey (10 YR 5/1) loam; mottled; medium nuciform structure; hard consistency; few stones; pH — 7.0.

C — Grey (10 YR 7/2) loam till; mottled; medium nuciform structure; hard consistency; moderately stony; gritty; calcareous; pH — 7.8.

The Parkhill loam is poorly drained. Note the dark surface underlain by the grey mottled materials.

Often areas of Parkhill loam, too small to be delineated on the soil map, are included with the better drained members. It is advisable to under-drain such areas so they can fit into the management programme used for the other series. In some locations lacustrine materials may be intermixed with the till. The topography consists of smooth, very gentle slopes. The natural drainage is poor and the tree cover in the remaining woodlots, is mainly elm, ash and cedar.

The areas of Parkhill loam mapped in Perth County are usually small and occur chiefly in the northern and southern parts of the County.

Agriculture

Crop production is limited to a large extent by poor drainage. In the undrained condition the soil produces fair forage crops but when tile drained the soil can be more intensively cropped and canning crops, corn, and beans can be grown where climate permits. Improved drainage also permits a better growth of red clover and alfalfa which increase soil nitrogen.

The chief fertility need on this soil is phosphate, and to a lesser extent potash and organic matter are required.

2. Till Composed of Pale Yellow-Brown Materials

(a) *Well Drained*

Harriston silt loam (33,400 acres)

Occurring chiefly in Wallace Township, Harriston silt loam is the well drained member of the Harriston catena and exhibits the characteristics of the Grey-Brown Podzolic Great Soil Group.

The following is a profile description of Harriston silt loam under woodlot conditions.

A_0 — Accumulated layer of partially decomposed litter from deciduous trees.

A_1 — 0–5 inches dark brown (10 YR 4/3) silt loam; fine granular structure; friable consistency; few stones; pH — 6.8.

A_{21}— 5–17 inches yellowish brown (10 YR 5/4) silt loam; weak platy structure; very friable consistency; stonefree; pH — 6.5.

A_{22}— 17–20 inches pale brown (10 YR 6/3) silt loam; weak platy structure; very friable consistency; stonefree; pH — 6.5.

B — 20–33 inches brown (10 YR 5/3) clay loam; medium nuciform structure; hard consistency; few to frequent stones; pH — 7.2.

C — 33 inches light yellow-brown (10 YR 6/4) loam till; medium nuciform structure; hard consistency; very stony; calcareous; pH — 7.8.

The bleached layer (A_{22} horizon) is not as well defined as in the grey limestone till soils possibly because it is masked by the pale brown colour. The topography is smooth moderately sloping except along stream courses where slopes are steeper. Erosion is moderate and natural drainage is good, runoff being high and internal drainage being moderate. Sugar maple, and beech most commonly occur in the forested areas although ash, ironwood and basswood are also present.

Agriculture

A considerable amount of general farming, including dairying and beef raising, is practised on the Harriston series. It grows good forage crops of alfalfa, red clover, grasses and sweet clover and is also well suited to fall wheat, oats, barley, corn and turnips. The tapping of hard maple trees for maple syrup provides a worthwhile income from the farm woodlot in many cases.

Sheet erosion is one of the main hazards to crop production but can be prevented in most areas with the use of long rotations and cover crops. Special practices such as strip-cropping, contour tillage etc., may be necessary on the

The Harriston silt loam is developed on loamy calcareous till. Well developed horizons are present.

steeper slopes to control soil loss. In some localities large stones occur in the surface layers and must be removed before the soil can be easily cultivated.

The Harriston soil has a fair supply of organic matter and potash but is low to very low in phosphate. Additions of high phosphate fertilizers along with barnyard manure are required for satisfactory crop yields.

Similar to the Guelph series the underlying material is lighter than that of the Huron series and allows greater infiltration of moisture permitting earlier spring cultivation.

(*b*) *Imperfect Drainage*

Listowel silt loam (59,900 acres)

Although the Listowel soil is imperfectly drained the profile exhibits sufficient Grey-Brown Podzolic characteristics to be included with that group.

The smooth moderately sloping Harriston silt loam is susceptible to sheet erosion.

The following is a generalized profile description occurring under virgin conditions.

A_0 — Accumulated layer of partially decomposed litter from deciduous trees and grasses.

A_1 — 0–4 inches very dark greyish brown (10 YR 3/2) silt loam; fine granular structure; friable consistency; few stones; pH — 6.9.

A_2 — 4–14 inches yellow-brown (10 YR 5/4) silt loam; mottled; fine platy structure; friable consistency; pH — 6.7.

B — 14–18 inches brown (10 YR 5/3) clay loam; mottled; medium nuciform structure; hard consistency; few to frequent stones; pH — 7.0.

C — Light yellow-brown (10 YR 6/4) loamy till; medium nuciform structure; hard consistency; many stones; calcareous; pH — 7.8.

The A_2 and B horizons are more poorly defined than in the Harriston silt loam. The topography is smooth gently sloping and erosion is slight. The natural drainage is imperfect consisting of medium runoff and moderate internal drainage. The natural forest vegetation is mostly soft maple and elm with some ash, ironwood and hard maple.

Agriculture

The Listowel soil supports diversified types of farming and in Perth County is used for general farming, dairying and poultry raising. Good yields are obtained from oats, red clover, hay and pasture and fair yields are obtained from wheat, barley, flax, corn and turnips.

Important considerations when farming Listowel silt loam are drainage, and fertility maintenance. The use of tile drains permits the growth of better crops of the soil-building legumes — alfalfa and red clover. The Listowel series is low in phosphate and organic matter. Additions of potassic and phosphatic fertilizers and barnyard manure are essential if the soil is to retain a good level of fertility.

C. SOILS DEVELOPED ON OUTWASH MATERIALS

1. Well Sorted Gravelly Materials

The well sorted gravelly materials occur as beaches or outwash plains and were deposited by moving water. The outwash materials of Perth County are similar in composition to the till materials, containing a large proportion of limestone with lesser amounts of shale. The Burford catena occurs on the well sorted gravelly outwash and consists of the well drained Burford series and the poorly drained Gilford series. The imperfectly drained member of the Burford catena was not mapped in Perth County.

(a) *Well Drained*

Burford loam (1,000 acres)

Burford loam exhibits well developed characteristics of the Grey-Brown Podzolic Great Soil Group and occurs chiefly in the northwestern part of the County.

The following is a description of a Burford loam profile.

A_0 — Accumulated layer of partially decomposed litter from deciduous trees.

A_1 — 0–6 inches very dark grey-brown (10 YR 3/2) gravelly loam; fine granular structure; friable consistency; few stones; pH — 6.5.

A_{21}— 6–17 inches yellowish brown (10 YR 5/4) slightly gravelly loam; weak platy structure; very friable consistency; pH — 6.3.

A_{22}— 17–19 inches light yellowish brown (10 YR 6/4) loam; slightly compacted; weak platy structure; very friable consistency; pH — 6.3.

B — 19–30 inches dark brown (10 YR 4/3) clay loam; gravelly; medium nuciform structure; firm consistency; pH — 7.0.

C — Grey (10 YR 7/2) well sorted gravelly and cobbly material; single-grain structure; loose consistency; calcareous; pH — 7.8.

The natural vegetation occurring in the woodlots is chiefly sugar maple and beech with some elm, ash, ironwood and basswood. The topography is smooth gently sloping. The external drainage is slow and the internal drainage is rapid.

Agriculture

In Perth County Burford loam is chiefly used for general farming but it is also adapted to the growing of cash crops. The soil is fairly well suited to small grains, corn, alfalfa, sweet clover, canning crops and tree fruits.

The principal limiting factor for growth on the Burford loam is low fertility since the soil is low in phosphate and moderately low in potash and organic matter. Addition of potassic, phosphatic and nitrogenous fertilizers will increase crop yields, particularly those of the cash crops. In some areas cobbles are near the surface and may interfere with cultivation.

The porous nature of the soil permits rapid percolation of water and therefore early spring cultivation can be accomplished.

(b) Poorly Drained

Gilford loam (500 acres)

Gilford loam is the poorly drained member of the Burford catena and is representative of the Dark Grey Gleisolic Great Soil Group.

The following is a generalized profile description:

A_0 — Accumulated layer of partially decomposed litter from deciduous and coniferous trees.

A_1 — 0–7 inches very dark brown (10 YR 2/2) loam; fine granular structure; friable consistency; frequent stones; pH — 7.0.

G — 7–27 inches light yellowish brown (10 YR 6/4) loam; very mottled; medium nuciform structure; firm consistency; pH — 7.2.

C — Light grey (10 YR 7/1) well sorted gravel; mottled; many cobblestones; single-grain structure; loose consistency; calcareous; pH — 7.8.

The water table is at the surface in the spring of the year and the drainage is slow. The topography is smooth very gently sloping and the natural vegetation found in the woodlots consists mainly of elm, ash, cedar and a few silver maple and aspen.

Agriculture

Much of the Gilford loam mapped in Perth County has been cleared and at one time was used for the production of general farm crops. However, poor natural drainage caused low yields in most crops and delayed spring planting.

The smooth gentle slopes of Listowel silt loam (foreground) often occur in association with the smooth moderate slopes of the well drained Harriston silt loam (background).

As a result most of the Gilford loam now supports permanent pasture. In late seasons buckwheat is often the only grain crop that is planted.

Gilford loam is well supplied with organic matter and phosphorus and potassium levels are slightly higher than those of the Burford series. Drainage improvement is necessary before satisfactory yields of most farm crops can be produced.

2. Poorly Sorted Gravelly Materials

The poorly sorted gravelly outwash is formed on materials derived largely from limestone bedrock and consists of coarse poorly sorted gravel with pockets of till and sand also present. These materials often occur as kames and eskers.

Donnybrook is the only series and is the only catenary member mapped in Perth County.

(a) *Well Drained*

Donnybrook sandy loam (3,700 acres)

Donnybrook sandy loam occurs in small areas throughout the County and is a Grey-Brown Podzolic soil.

The following is a description of a Donnybrook sandy loam profile.

A_0 — Accumulated layer of partially decomposed litter from deciduous trees.

A_1 — 0–4 inches dark brown (10 YR 4/3) sandy loam; fine crumb structure; very friable consistency; few to frequent stones; pH — 6.8.

A_{21}— 4–20 inches yellow-brown (10 YR 5/6) sand; weak platy structure; very friable consistency; gravelly; pH — 6.6.

A_{22}— 20–23 inches pale brown (10 YR 6/3) sand and gravel; very weak platy structure; very friable consistency; pH — 6.6.

B — 23–35 inches dark brown (10 YR 4/3) sandy loam; gravelly; weak nuciform structure; friable consistency; frequent stones; pH — 7.4.

C — Very pale brown (10 YR 7/3) poorly sorted sand and gravel; single grain structure; loose consistency; frequent stones; calcareous; pH — 7.8.

Where the Donnybrook is mapped on eskeroid materials the horizons are often poorly defined. Often a dark coloured surface layer is underlain by dark brown sandy loam which grades into pale brown parent material. The stoniness is variable.

Donnybrook sandy loam is an irregular steeply sloping soil with good natural drainage. The soil developed under a tree cover consisting mainly of sugar maple and beech.

Agriculture

Much of the Donnybrook sandy loam mapped in Perth County consists of long ridges known as eskers. Such formations are used for permanent pasture or tree growth. However, where kame formations occur general farming is carried on and fair yields of cereal grains, hay and pasture are obtained.

Donnybrook soils are susceptible to and have suffered extensively from erosion. The short irregular slopes make contour cultivation and strip cropping impractical. Consequently erosion control consists of keeping the soil under cover as long as possible and practising a minimum of cultivation.

The soil is low in organic matter, phosphate and potash and will respond to applications of manure and commercial fertilizer. Boulders may occur in the upper part of the profile making cultivation difficult. The most desirable formation is that where there is a foot or two of sandy loam covering the gravelly and stony materials. Rapid internal drainage and high surface runoff permit early spring cultivation.

3. Poorly Sorted Sandy Materials

Poorly sorted materials in which sand is the dominant constituent usually occur as kames and consist of sand with pockets of till or gravel included. Soils developed on these materials are members of the Waterloo catena of which the Waterloo is the well drained and only member mapped in Perth County.

(a) *Well Drained*

Waterloo sandy loam (2,900 acres)

Having characteristics similar to those of the Grey-Brown Podzolic Great Soil Group, Waterloo sandy loam is most commonly found in the Township of Easthope North.

The following is a profile description of Waterloo sandy loam developed under tree cover.

A_0 — Accumulated layer of partially decomposed litter from deciduous trees.

A_1 — 0–4 inches dark brown (10 YR 4/3) sandy loam; fine crumb structure; friable consistency; slightly stony; pH — 6.5.

A_{21}— 4–14 inches light yellowish brown (10 YR 6/4) sandy loam; weak platy structure; very friable consistency; stonefree; pH — 6.3.

A_{22}— 14–16 inches pale brown (10 YR 6/4) sandy loam; weak platy structure; very friable consistency; stonefree; pH — 6.4.

B — 16–25 inches brown (10 YR 5/3) loam; fine nuciform structure; firm consistency; few stones; pH — 7.0.

C — Light grey (10 YR 7/2) sand; single-grain structure; loose consistency; stonefree; calcareous; pH — 7.8.

Waterloo sandy loam is a well drained soil that developed under a forest vegetation consisting mainly of sugar maple and beech. The topography is irregular steeply sloping and erosion is severe.

Agriculture

Most of the Waterloo sandy loam has been cleared and is used for general farming. Fair yields of cereal grains, hay and pasture can be obtained. Susceptibility to erosion prohibits the growth of many specialized crops that might otherwise do well on this soil. Soil loss is best prevented by keeping the land under cover for as long as possible and by using a minimum of cultivation. Complex topography prevents the use of contour cultivation and strip cropping.

Droughtiness, low fertility levels and low organic matter content also limit crop production. The soil responds to potassic, phosphatic and nitrogenous fertilization. Additions of barnyard manure are necessary to maintain and increase the organic matter content.

D. ALLUVIAL MATERIALS

Bottom land (32,700 acres)

The land lying along stream courses which is subject to flooding is designated as Bottom Land. Except in local areas along large rivers, this flood land is quite narrow and sometimes it is necessary to exaggerate the width of Bottom Land on the map in order to show the drainage pattern of the County. These soils are the most recently deposited and deposition may still take place during periodical flooding. The soil is usually made up of successive layers of silt, sand and clay intermixed with layers of organic matter. There is very little horizon differentiation and the soil usually grades in colour from the surface down. The tree vegetation consists mainly of elm, ash and willows.

Agriculture

Grazing is the chief agronomic use of these flood lands. Where a regional conservation plan is put into effect, many of the flood plains and eroded banks should be reforested while others should be cleared of brush and trees and kept in grass to provide for the free movement of water at flood time. Some cultivated crops can be grown where broad areas occur and where flooding is mainly in early spring.

Organic Soils

These soils usually occur in depressional areas which have been wet throughout the years. Remains of trees, shrubs, sedges, etc. have accumulated and built up several feet of organic material over the rock or soil materials. Where the original plants are well decomposed the soil is known as "Muck" but where the woody or fibrous material still retains much of its original form it is known as "Peat." Only Muck has been mapped in Perth County.

Muck (9,900 acres)

Large areas of muck occur in Ellice, Elma, and North Easthope Townships. Other areas are small and widely scattered throughout the County.

The topography is level to depressional and the drainage ranges from very poor to ponded. The tree vegetation consists mainly of elm, ash, white cedar, and a few spruce.

The profile of a muck soil usually does not exhibit the characteristic layering commonly found on a mineral soil. The following description indicates the arrangement of the layers.

$_1$ — Very dark grey or black (10 YR 2/1); well decomposed organic materials derived from sedges, leaves, and other readily decomposable material; exceeds twelve inches in depth; neutral in reaction.

$_2$ — The second layer contains more woody material and is less well decomposed.

$_3$ — This layer is usually black in colour, very sticky, and well decomposed.

$_4$ — At variable depths the organic materials may be underlain by clay, till, or sand.

Agriculture

The muck soils are not used extensively for cultivated crops and a large proportion of them remain under tree cover. However, they are well suited to intensive farming and to gardening when fertilizers are used to supplement the potash and phosphate deficiencies. Drainage must be improved before satisfactory crop yields can be obtained and moisture must be then provided during the dry summer months by irrigation. The development of drainage and irrigation may prove costly. Areas which are particularly difficult to drain may be used as a source of organic matter to enrich the surrounding mineral soils.

PART IV

AGRICULTURE AND LAND USE

Early Settlement and Agricultural Development

Settlement took place from 1829 to 1850 commencing in South Easthope and ending in Elma and Wallace.

In 1881, 21 per cent of the entire acreage was still covered with timber consisting of beech, elm, maple, basswood, black and white ash, pine, hemlock, cedar, birch and tamarack. It was chiefly used for lumber, fencing and firewood. At this time, firewood was selling at $2.00 and $2.50 a cord.

The Report of the Agricultural Commission for 1881 also states that about 16½ per cent of the cleared acreage had been drained, about one-third being with tile.

Fertilizers in the form of salt were being applied 200–400 pounds to the acre to approximately 14 per cent of the land.

There were 30 cheese factories in Perth in 1881 along with several agricultural implement, broom, pump and carriage factories, saltworks at Dublin, woollen, grist, oatmeal and sawmills, tanneries, a brewery, a vinegar factory, a brick and drain tile yard and many smaller industries.

Present Agriculture

The following table shows that over 95 per cent of the Perth County lands are used extensively for agriculture and associated grazing and forestry purposes.

TABLE 5

PRESENT LAND USE (1941 CENSUS)

A.	Total land area	537,600 acres	100.0%
	Occupied land	515,465 "	95.8%
	Improved occupied land	450,540 "	83.8%
	Unimproved occupied land	64,925 "	12.0%
	Including:		
	Woodland	31,749 "	
	Natural pasture	27,192 "	
	Marsh or waste land	5,894 "	
B.	Number of Farms		4,899
	Average Acreage per Farm		105
	Average Improved Cleared Land per Farm		92

From the above figures it will be noted that the average size of farm in Perth County is 105 acres, of which approximately 92 acres are cultivated for the growing of general farm crops. Woodlots average 6 acres in size.

Fine herds of Holstein cattle are found in Perth County. The barnyard manure produced can be used to advantage to maintain organic matter levels.

TABLE 6

ACREAGE OF CROPS IN PERTH COUNTY*

	Acres	Average Yield per Acre
Pasture	106,900	
Mixed grains	100,200	55.0 bu.
Hay and clover	84,600	1.90 tons
Oats	57,200	53.0 bu.
Fall wheat	30,300	33.0 bu.
Corn for silo	15,800	9.2 tons
Barley	14,000	44.0 bu.
Alfalfa	13,200	2.18 tons
Corn for husking	5,000	47.0 bu.
Field roots	2,600	500 bu.
Rye	1,900	21.0 bu.
Potatoes	1,300	160 bu.
Flax	800	12.0 bu.
Spring wheat	800	23.0 bu.
Buckwheat	700	22.0 bu.
Peas	400	18.0 bu.
Beans	50	17.0 bu.
Soybeans	50	20.0 bu.

Annual Report of the Statistics Branch, 1950, Ontario Department of Agriculture, 1951.

From Table 6 it is seen that seeded pasture, cereal grains and cultivated hay occupy a large part of the total land area of Perth County.

The dairy industry is of prime importance and there are several fine herds of Holstein cattle located in the County. Many creameries and cheese factories throughout the County, and neighbouring counties, supply a ready market for fluid milk. According to the Ontario Department of Agriculture's Report of the Statistics Branch for 1950 the County is one of the largest producers of butter and cheddar cheese in Ontario, having made 4,784,976 pounds of butter and 2,,896,895 pounds of cheddar cheese in 1950.

The types of farms occurring in Perth County are shown in Table 7. The farm income is derived chiefly from livestock raising, mixed farming, or dairying.

TABLE 7

TYPE OF FARM IN PERTH COUNTY
(1941 Census)

Type of Farm	Number
Livestock	2,172
Mixed farming	1,443
Dairy products	445
Subsistence and combinations of subsistence	334
Part-time	83
Poultry	79
Grains and hay	77
Vegetables, fruits, and nursery products	17
Forest and apiary products	11
Potatoes, roots, and other field crops	4

The above classification is based on the main source or sources of farm revenue. For example, livestock farms are farms where the revenue from the sale of cattle, swine, horses, goats and fur-bearing animals constituted 50 per cent or more of the gross revenue. Similarly, mixed farms are farms where the revenue from two or more of the other main types of products was required to produce 50 per cent or more of the gross revenue. Farms on which the value of products consumed or used by the farm household amounted to 50 per cent or more of the gross farm revenue were classed as subsistence farms. Combinations of subsistence farms are farms where the value of the products used or consumed and the revenue of another main type such as poultry, livestock, etc., were required to form 50 per cent or more of the gross farm revenue.

The Utilization and Management of Perth County Soils

The proper use and management of soils is essential in any area to prevent the waste of soil resources. In order to achieve better land use, basic information about land resources must be obtained and land-planning movements should be initiated. Land-planning includes the examination of soil characteristics and types, with special reference to productivity, slope and erosion. Some of these physical factors such as topography, texture, depth of bedrock, etc., a farmer does not attempt to change, but others, such as stoniness, structure, moisture-holding capacity, etc., can be modified to increase the productivity of the soil. To carry on profitable agriculture the system of farming must be adapted to these characteristics. Today the intensity of use is of growing concern. Therefore, a knowledge of the above factors is essential to maintain soil in the best physical state, to obtain optimum results in the production of crops, and to determine the types of agriculture which can best be practised under a given set of economic conditions.

A land use classification such as this requires extensive study which cannot be made during the initial work of classifying soils. However, certain general recommendations are made which may prove to be helpful. For purposes of discussion the soils of Perth County have been grouped on a textural and drainage basis. The soils are delineated according to these groups in Fig. 9 which also shows the topography associated with each group. The distribution of the soils according to texture is shown in Fig. 10.

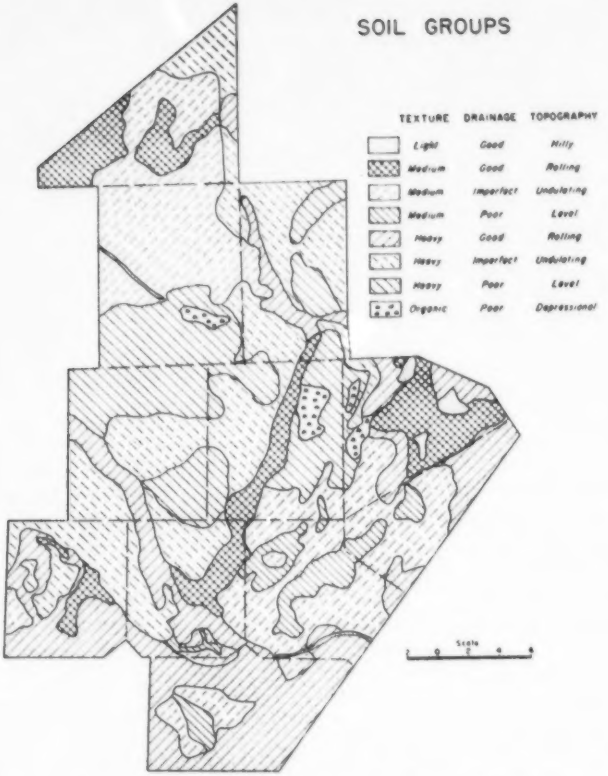


FIG. 9—Outline map of Perth County showing the soils grouped according to texture, drainage and topography.

1. CLAY LOAM AND SILT LOAM SOILS

TABLE 8

ACREAGE OF CLAY LOAM AND SILT LOAM SOILS

Soil Type	Acreage	% of Total
(a) Well drained		
Huron clay loam	88,100	16.3
Huron silt loam	17,800	3.3
Total	105,900	19.6
(b) Imperfectly drained		
Perth clay loam	112,500	20.9
Perth silt loam	49,900	9.3
Total	162,400	30.2
(c) Poorly drained		
Brookston clay loam	78,200	14.5
Brookston silt loam	52,100	6.0
Total	130,300	20.5

Hawthorne and wild carrot decrease the productivity of many pastures.

Almost 400,000 acres or 70 per cent of the soils mapped in Perth County are heavy textured. As pointed out in the series descriptions (Part III) the components of this group vary only in drainage.

The well drained Huron soils are suited to many different types of farming. These soils are adapted to the growth of cereal grains, alfalfa, hay and pasture. Specialized crops such as peas, beans, and corn also do well.

Sheet erosion presents the greatest hazard to land use and is best prevented on the Huron soils by the use of long rotations and cover crops. Where the slopes are long, special practices such as contour tilling and strip cropping can be employed.

The Huron soils are low in phosphorus and contain medium to low amounts of potassium and organic matter. Commercial fertilizer and barnyard manure should be added to the soil to maintain a satisfactory fertility level.

The imperfectly drained, heavy textured soils include the Perth series. Drainage is the main requirement contributing to successful land use on the Perth series. Imperfectly drained soils present their greatest problem during wet seasons when slow runoff and low permeability prevent the escape of the water. Tile drains are beneficial, particularly during wet seasons, permitting a wider range of crops to be grown.

Crops commonly grown on the Perth soils are wheat, oats, barley, red clover, hay, corn and pasture. For best results fertility should be maintained by additions of fertilizer and barnyard manure. Specialized crops such as peas, beans and turnips do well, particularly when the soil is drained.

Poor drainage limits the production of a wide range of crops on the Brookston soils except where they are tile drained.

There are many detrimental effects of poor drainage. Poorly drained soils warm up slowly in the spring and cool slowly in the fall because of the high

heat-absorbing capacity of water which requires a great addition or loss of heat to bring about a change in temperature. The coldness of these soils during the spring season is one of the limiting factors in their use for crop production. The high moisture content also delays planting and, thus, necessitates their use for late-planted crops or else for the seeding of early crops in poorly prepared soil. The roots of plants require a supply of oxygen for the process of respiration and, since poorly drained soils have a very low proportion of air, the roots tend to suffocate. With the inadequate supply of oxygen, decomposition of organic matter must be largely of an anaerobic nature, resulting in production of materials, some of which are toxic to plants. With the hampered decay of organic matter, there is little release of available nutrients necessary for plant growth. Nitrification is a process of converting ammonia nitrogen to nitrate nitrogen, making the nitrogen available to the plant. This process is accomplished by organisms in the soil that require oxygen before they can work. Thus, lack of oxygen in poorly drained soils prevents the formation of available nitrogen for the plants. Improved drainage will therefore benefit the poorly drained soils by creating a better medium for the growth of agricultural crops.

The poorly drained heavy textured soils of Perth County are found mainly in the Townships of Elma, Logan, Ellice, Mornington and Downie.

In their natural condition, Brookston soils are well supplied with organic matter, phosphorus and potassium. However, when intensively cropped, these soils require additions of barnyard manure and commercial fertilizer to maintain soil fertility. Crops such as red clover, timothy, and pasture are fairly well suited to Brookston soils. Alfalfa, wheat, oats, peas, beans, flax and corn can be successfully grown when drainage is improved.

2. LOAM AND SILT LOAM SOILS

TABLE 9

ACREAGE OF LOAM AND SILT LOAM SOILS

Soil Type	Acreage	% of Total
(a) Well drained		
Harriston silt loam	33,400	6.2
Guelph loam	2,600	.5
Burford loam	1,000	.2
Total	37,000	6.9
(b) Imperfectly drained		
Listowel silt loam	59,900	11.1
London loam	100	.02
Total	60,000	11.12
(c) Poorly drained		
Parkhill loam	12,300	2.3
Gilford loam	500	.1
Total	12,800	2.4

With satisfactory rotations and good soil management the well drained loam and silt loam soils produce good yields of most farm crops. Occurring on rolling till plains the Harriston and Guelph are susceptible to sheet erosion which can be adequately controlled by the use of relatively simple erosion control measures. The Harriston, Guelph and particularly the Burford soils

Crop residues should be ploughed under to aid in the preservation of organic matter and the maintenance of a satisfactory soil structure.

respond to applications of potassic, phosphatic and nitrogenous fertilizers. Soil management practices that provide more organic matter and maintain fertility levels are desirable.

The Listowel and London series are the imperfectly drained members of Harriston and Guelph catenas respectively. The imperfect drainage narrows the range of crops that can be grown. Good yields of red clover, alsike, timothy and pasture can be obtained but these soils are not well suited to the production of alfalfa due to unsatisfactory drainage conditions. Additions of manure and fertilizer are required to maintain satisfactory fertility levels.

Poor drainage limits the usefulness of the Gilford and Parkhill soils. As a result, a great proportion of these soils are left in pasture or woodland. Improved drainage would increase the usefulness of these soils, since inherently they are fairly well supplied with plant nutrients. Installation of tile drains may prove difficult in some areas, due to depressional topography. These soils are well supplied with organic matter, and respond to applications of mineral fertilizers. Satisfactory physical condition can be maintained by the use of good soil management practices.

3. SANDY LOAM SOILS

TABLE 10

ACREAGE OF SANDY LOAM SOILS

Soil Type	Acreage	% of Total
(a) Well drained		
Donnybrook sandy loam	3,700	.7
Waterloo sandy loam	3,900	.5
Total	6,600	1.2

Crop production on these soils is limited by such factors as susceptibility to erosion and low fertility. Inherently they are low in plant nutrients and organic matter and frequent additions of mineral fertilizer and manure are

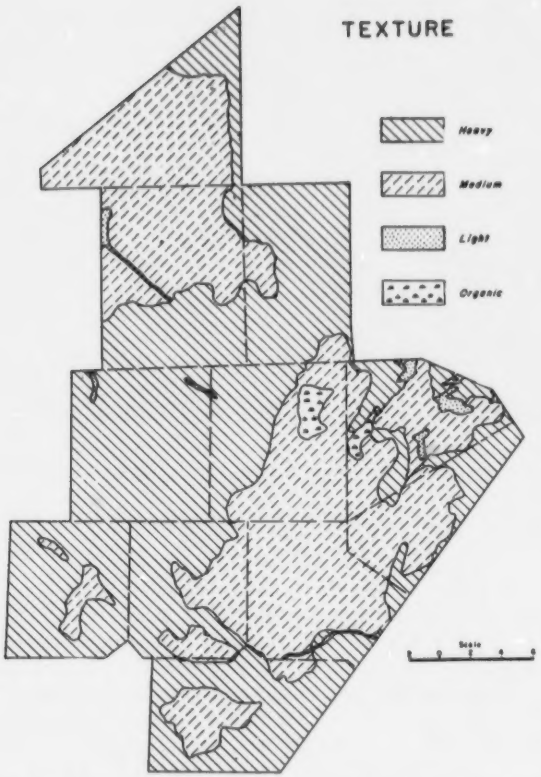


FIG. 10—Outline map of Perth County showing distribution of light, medium and heavy textured soils.

required to maintain soil fertility. Under cultivation the Donnybrook and Waterloo soils suffer fairly extensively from wind erosion. Areas where the loss of soil has been extensive might well be returned to tree cover. Long rotations should be used in other areas to prevent, as much as possible, a further loss of soil. Stones present a problem on the Donnybrook sandy loam and should be removed to simplify cultivation.

Problem Areas

The Soil Survey of Perth County revealed that there are definite problems affecting the use of the soil in the area for agricultural purposes. Although a detailed discussion of the problems affecting the use of Perth County soils has already been presented in Parts III and IV, further discussion is presented here to add to the information already given. Accordingly an outline map (Fig. 11) has been prepared to indicate the main problem areas in the County. The main problems that occur in the County may be attributed to the effect of one or a combination of two or more of such factors as susceptibility to erosion, inadequate drainage, and lack of fertility. There are areas in Perth County where, provided good soil management practices are employed, the soils can be used without any serious problem developing.

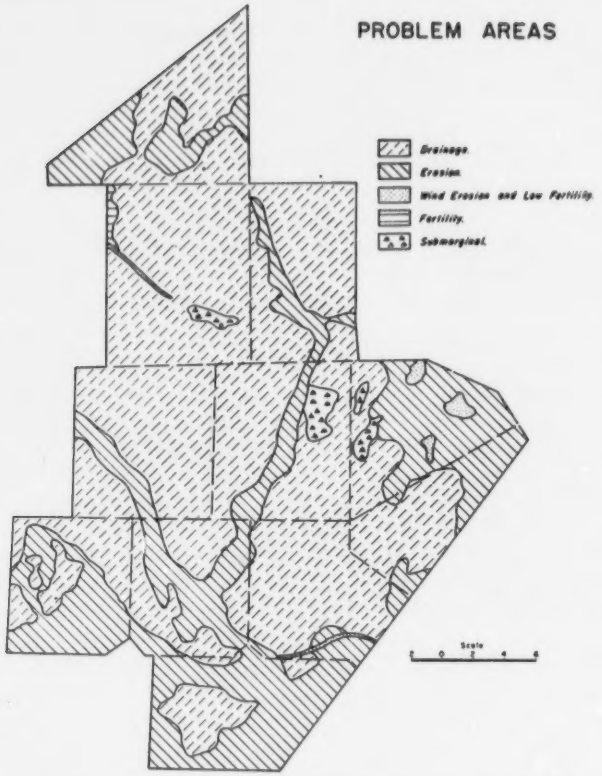


FIG. 11—Outline map of Perth County showing distribution of problem areas.

Drainage

Over half the County suffers from unsatisfactory drainage. Drainage problems occur when water runoff is slow because of insufficient slope or when water percolation is impeded due to the impermeability of the underlying materials. The drainage classes for Perth County are delineated in Fig. 12. Areas of good drainage are those where the topography permits rapid runoff of water or where permeable materials permit rapid percolation. In areas where imperfect, poor or very poor drainage occur water movement is impeded by either or both topography and impermeability of the underlying materials.

TABLE 11

ACREAGES OF GOOD, IMPERFECT, POOR, AND VERY POOR DRAINAGE

Drainage	Acreage	% of Total
Good	182,200	33.8
Imperfect	222,400	41.4
Drainage	**Acreage**	**% of Total**
Poor	123,100	22.9
Very Poor	9,900	1.9

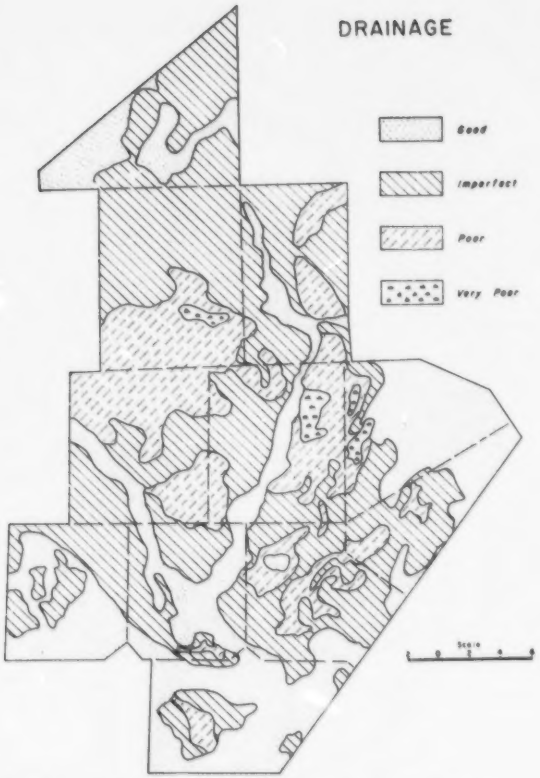


FIG. 12—Outline map of Perth County showing distribution of drainage classes.

Erosion

Loss of valuable topsoil through erosion is closely related to topography and texture of the soil. The smooth moderately rolling till soils with loam to clay loam texture are the soils most susceptible to erosion in Perth County. Slight erosion occurs where the topography is gently sloping and areas where the topography is level to depressional have little or no erosion problem.

Wind Erosion and Low Fertility

Wind erosion occurs on the sandy, steeply sloping soils of the County. Where these soils are cultivated and left without cover the finer materials are soon blown away leaving only the coarse sand. The sandy soils of the County are low to very low in potash, phosphate and nitrogen, and fertility should be increased and maintained by the addition of mineral fertilizer and manure.

Fertility

Rapid percolation of water through the well drained gravelly soils mapped in Perth County carries with it many of the minerals needed for optimum plant growth. Frequent additions of fertilizer and manure are needed to maintain soil fertility.

Submarginal

The submarginal lands in Perth County are those which cannot be used for the production of farm crops commonly grown in the area. Periodic flooding prevents the use of bottom land for anything but grazing. Muck is very poorly drained and therefore is not adapted to the growth of most farm crops.

Crop Adaptability and Productivity Ratings for Perth County Soils

Differences in the productive capacity of different kinds of soils are commonly recognized on the basis of experience in farming. The range in productive capacity of different soil types is very evident where the same crops are grown and the same general farming practices are followed.

Soils can be rated on the basis of natural productivity or inherent fertility but only by an assumption that management factors are constant. The ratings, in this case, are based on general productivity, workability and conservability of each soil in relation to the production of a specific crop. It is necessary to evaluate both the internal and external features of the soil in order to get the best rating possible. Internal features of the soil which affect plant growth are mainly those concerned with the maintenance of plant nutrients and the supply of moisture. These factors are: organic matter content, structure, texture, water and nutrient reserve together with factors influencing their availability. The external factors are those affecting workability and conservability. Such factors are: stoniness, topography, external drainage and erodibility.

The best measure of crop adaptability under specific management conditions is the average yield of each crop. Such yield data is not available and so an estimate was made from information gathered on the soil requirements of various crops and the degree to which specific soils possess these requirements. General observations made during the survey and information supplied by local farmers aided in establishing these ratings. The soils have been placed in six groups and are rated for twelve crops commonly grown in the area as shown in Tables 12–22.

Since management is an important factor affecting productivity, the ratings should be considered an average representing the crop response under the commonest practices of management in the County. The use of better tillage methods, more carefully selected seed of improved crop varieties and more suitable rates, dates and methods of planting may even increase yields for a period in spite of a lower soil fertility. Practices usually followed in the County consist of (1) the extensive use of barnyard manure which will aid a great deal in maintaining the organic matter level in the soil; (2) the use of tile drains and open ditches in inadequately drained areas; (3) the moderate use of commercial fertilizers.

TABLE 12

CROP ADAPTABILITY RATINGS FOR GOOD CROPLAND*

Soil Type	Wheat	Oats	Barley	Alfalfa	Red Clover	Alsike	Timothy	Corn	Flax	Peas and Beans	Tree Fruits	Pasture
	† N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Harriston silt loam	G	G	G	G	G	G	G	G–F	G	G–F	G–F	G
Guelph loam	G	G	G	G	G	G	G	G–F	G–F	G–F	G–F	G
Huron silt loam	G	G	G	G	G	G	G	G–F	G	G–F	F	G
Huron clay loam	G	G	G	G	G	G	G	G–F	G	G–F	F	G

* Crop adaptability ratings for each soil type as follows:

G — Good; G–F — Good to Fair; F — Fair; F–P — Fair to Poor; P — Poor.

† N.D. — Natural Drainage.

TABLE 13

ACREAGES OF GOOD CROPLAND

Soil Type	Acreage	% of Total	Limitations
Harriston silt loam	33,400	6.2	Susceptibility to erosion
Guelph loam	2,600	.5	Susceptibility to erosion
Huron silt loam	17,800	3.3	Susceptibility to erosion
Huron clay loam	33,400	16.3	Susceptibility to erosion
Total	141,900	26.3	

TABLE 14

CROP ADAPTABILITY RATINGS FOR GOOD TO FAIR CROPLAND*

Soil Type	Wheat		Oats		Barley		Alfalfa		Red Clover		Alsike		Timothy		Corn		Flax		Peas and Beans		Tree Fruits		Pasture	
	† N.D.	‡ T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.
Burford loam	G–F		G–F		G–F		F		F		F		F		G–F		G–F		G–F		G–F		G–F	
Listowel silt loam	F	G–F	G–F	G	F	G	F	G–F	G–F	G	G	G	G	G	G–F	G	G–F	G	F	G–F	F	G–F	G	G
London loam	F	G–F	G–F	G	F	G	F	G–F	G–F	G	G	G	G	G	G–F	G	F	G–F	F	G–F	F	G–F	G	G
Perth clay loam	F	G–F	G–F	G	F	G	F	G–F	G–F	G	G	G	G	G	F	G–F	G–F	G	F	G–F	F–P	F	G	G
Perth silt loam	F	G–F	G–F	G	F	G	F	G–F	G–F	G	G	G	G	G	F	G–F	G–F	G	F	G–F	F–P	F	G	G
Brookston clay loam	P	G–F	F	G	F	G	P	F	F	G	F	G	F	G	F–P	G–F	F	G	F–P	G–F	P	F–P	G–F	G
Brookston silt loam	P	G–F	F	G	F	G	P	F	F	G	F	G	F	G	F–P	G–F	F	G	F–P	G–F	P	F–P	G–F	G

* The crop adaptability rating for each soil type as follows:
G — Good; G–F — Good to Fair; F — Fair; F–P — Fair to Poor; P — Poor.

† N.D. — Natural Drainage. ‡ T.D. — Tile Drainage.

TABLE 15

ACREAGES OF GOOD TO FAIR CROPLAND

Soil Type	Acreage	% of Total	Limitations
Burford loam	1,000	.2	Low fertility
Listowel silt loam	59,900	11.1	Imperfect drainage
London loam	100	.01	Imperfect drainage
Perth clay loam	112,500	20.9	Imperfect drainage
Perth silt loam	49,900	9.3	Imperfect drainage
Brookston clay loam	78,200	14.5	Poor drainage
Brookston silt loam	32,100	6.0	Poor drainage
Total	333,700	63.01	

TABLE 16

CROP ADAPTABILITY RATINGS FOR FAIR CROPLAND*

Soil Type	Wheat		Oats		Barley		Alfalfa		Red Clover		Alsike		Timothy		Corn		Flax		Peas and Beans		Tree Fruits		Pasture	
	† N.D.	‡ T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.
Parkhill loam	P	F	F-P	F	P	F-P	P	F-P	P	F	F	G-F	F	G-F	P	F	F-P	F	P	F	P	P	F	G-F

* Crop adaptability rating for each soil type as follows:
G — Good; G-F — Good to Fair; F — Fair; F-P — Fair to Poor; P — Poor.
† N.D. — Natural Drainage. ‡ T.D. — Tile Drainage.

TABLE 17

ACREAGE OF FAIR CROPLAND

Soil Type	Acreage	% of Total	Limitations
Parkhill loam	12,300	2.3	Poor drainage

TABLE 18

CROP ADAPTABILITY RATINGS FOR FAIR TO POOR CROPLAND*

Soil Type	Wheat	Oats	Barley	Alfalfa	Red Clover	Alsike	Timothy	Corn	Flax	Peas and Beans	Tree Fruits	Pasture
	† N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Waterloo sandy loam	F-P	F-P	P	F	F	F	F-P	P	P	P	F-P	F
Donnybrook sandy loam	F-P	F-P	P	F	F	F	F-P	P	P	P	F-P	F

* Crop adaptability ratings for each soil type as follows:
G — Good; G-F — Good to Fair; F — Fair; F-P — Fair to Poor; P — Poor.
† N.D. — Natural Drainage.

TABLE 19

ACREAGES OF FAIR TO POOR CROPLAND

Soil Type	Acreage	% of Total	Limitations
Waterloo sandy loam	2,900	.5	Susceptibility to erosion and low fertility
Donnybrook sandy loam	3,700	.7	Susceptibility to erosion and low fertility
Total	6,600	1.2	

TABLE 20

CROP ADAPTABILITY RATINGS FOR POOR CROPLAND*

Soil Type	Wheat		Oats		Barley		Alfalfa		Red Clover		Alsike		Timothy		Corn		Flax		Peas and Beans		Tree Fruits		Pasture	
	† N.D.	‡ T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.	N.D.	T.D.
Gilford loam	P	F-P	P	F-P	P	F-P	P	P	P	F-P	P	F	P	F-P	P	P	P	P	P	F-P	P	P	F-P	F-P

* Crop adaptability rating for each soil type as follows:

G — Good; G-F — Good to Fair; F — Fair; F-P — Fair to Poor; P — Poor.

† N.D. — Natural Drainage. ‡ T.D. — Tile Drainage.

TABLE 21

ACREAGE OF POOR CROPLAND

Soil Type	Acreage	% of Total	Limitations
Gilford loam	500	.1	Poor drainage

TABLE 22

CROP ADAPTABILITY RATINGS FOR SUBMARGINAL CROPLAND*

Soil Type	Wheat	Oats	Barley	Alfalfa	Red Clover	Alsike	Timothy	Corn	Flax	Peas and Beans	Tree Fruits	Pasture
	† N.D. ‡ T.D.	N.D. T.D.	N.D. T.D.	N.D. T.D.	N.D. T.D.	N.D. T.D.	N.D. T.D.	N.D. T.D.	N.D. T.D.	N.D. T.D.	N.D. T.D.	N.D. T.D.
Bottom Land	P P	P P	P P	P P	P P	P P	P P	P P	P P	P P	P P	G P P
Muck												

* Crop adaptability ratings for each soil type as follows:
G — Good; G–F — Good to Fair; F — Fair; F–P — Fair to Poor; P — Poor.
† N.D. — Natural Drainage. ‡ T.D. — Tile Drainage.

TABLE 23

ACREAGES FOR SUBMARGINAL CROPLAND

Soil Type	Acreage	% of Total	Limitations
Bottom Land	32,700	6.0	Susceptibility to periodic flooding
Muck	9,900	1.8	Very poor drainage
Total	42,600	7.8	

PART V

DISCUSSION OF ANALYTICAL DATA

The results of the chemical analyses of surface soils in Table 24 give an indication of the comparative levels of available nutrients in the surface soils of the County. The physical analyses indicate the relative amounts of sand, silt and clay, and in this way serve as a check on the estimates of the soil texture taken while in the field.

Sampling

The number of samples taken on each soil type has been governed to a large degree by the extent and importance of that type. The crop history of the fields, from which the samples were taken, in most cases was not obtained. In order to compensate for this, most of the samples were taken from old pastures so that the management factor would be as nearly equal as possible. This has been the regular practice of the Ontario Soil Survey for several years.

Mechanical Analysis

The Bouyoucos Hydrometer Method was used to determine the mechanical composition of the Perth County soils. The amount of each size group of particles (soil separate) is reported on a percentage basis.

Soil Classes and Percentage of Various Soil Separates in Each Class*

I. Soils containing less than 20 per cent clay and 50–80 per cent sand.
   (a) Sandy loam — soil with 50–80 per cent sand and less than 20 per cent clay.

II. Soils containing less than 20 per cent clay, less than 50 per cent silt and less than 50 per cent sand.
   (a) Loam — soil with less than 20 per cent clay and less than 50 per cent silt.

III. Soils containing over 50 per cent silt and less than 20 per cent clay.
   (a) Silt loam — soils with over 50 per cent silt and less than 20 per cent clay.

IV. Soils containing more than 20 per cent clay.
   (a) Clay loam — soils with 20–30 per cent clay and less than 50 per cent silt.

Reaction

The soils of Perth County range in reaction from 6.0 to 8.0. However, the majority of the soils analyzed have a pH ranging from 6.5 to 7.5. It is doubtful that liming would benefit any of the soils in the County.

Phosphorus

The Lohse and Ruhnke method of determining readily soluble phosphorus was employed for Perth County soils. The total phosphorus in the soils was

* Soil classes which are used throughout this report.

not determined. The above authors state that soils containing 60 pounds or less of readily soluble phosphorus per acre will have a marked phosphate deficiency. Although no figure has been suggested to indicate what may be a sufficient amount of phosphorus for general farm crops, 200 pounds per acre might be accepted as a tentative figure for soils of neutral reaction. Table 24 indicates that a large proportion of the soils of Perth County are low in readily soluble phosphorus. About. 50 per cent of the soils have less than 60 pounds available phosphorus to the acre and 88 per cent have less than 200 pounds per acre.

Potassium

Approximately 167 pounds of replaceable potassium per acre is considered necessary for the production of general farm crops. It will be noted from Table 24 that the soils of Perth County are fairly well supplied with replaceable potassium. Potassium fertilization is necessary on specialized crops such as fruits and vegetables which require extra potassium.

Calcium and Magnesium

The elements calcium and magnesium are both derived chiefly from the carbonate forms in which they occur in limestone bedrock. Conditions which effect the breakdown of the limestone affect the availability of these two elements. The exchangeable forms of calcium and magnesium represent the major proportion of the available supply and, according to Truog, in fertile loam soils that are not more than slightly acid, this commonly amounts to 3,000 to 5,000 pounds per acre plow layer of calcium and about one-fourth to one-third as much magnesium. On this basis most of the soils of Perth County are well supplied with calcium and magnesium.

Organic Matter

The organic matter content as reported in Table 24 indicates the levels that occur in permanent pastures. It is reasonable to expect that organic matter levels in permanent pastures will be higher than those found in areas where short rotations are followed and particularly where there is a high concentration of cash crops such as corn, peas, and beans.

The organic matter content is highest in the poorly drained heavy textured soils and lowest in the well drained, light textured soils. In general the organic matter content of the Perth County soils is fairly satisfactory. However, the need for adequate organic matter maintenance cannot be over-emphasized especially in areas where improved drainage and continuous cropping have been practised.

BASE EXCHANGE CAPACITY AND PER CENT SATURATION

The base exchange capacity and per cent saturation of surface samples from Perth County are presented in Table 25.

Base Exchange Capacity

Clay particles less than .002 mm. in size are colloidal as is a large part of the organic matter. All particles of colloidal size, either organic or inorganic, have the ability to hold basic (positively charged) ions (eg. Ca^{++}, Mg^{++},

K^+, Na^+, H^+) on their surfaces. A positively charged ion held on a colloid may be replaced or exchanged by another positively charged ion from the soil solution. Such a reaction is called "Base Exchange." The number of basic ions (cations) which a colloid can hold is expressed in milliequivalents. The number of milliequivalents of cations which 100 gms. of soil will absorb is known as "Base Exchange Capacity." Hence, the Base Exchange Capacity of a soil is the number of milliequivalents of cations which the colloidal fraction of 100 gms. of soil can adsorb. The Base Exchange Capacity increases as the amount of material of colloidal size increases.

Per Cent Saturation

The per cent saturation with a cation (eg. H^+, Ca^{++}, Mg^{++}, K^+) is a useful means of expressing the milliequivalents of any one cation which are adsorbed by the colloid in relation to the total number which could be adsorbed (i.e Base Exchange Capacity). For example, in Table 25 the per cent saturation with calcium indicates the proportion of the exchange capacity which is occupied by calcium.

The base exchange capacity of the Perth County soils varies as much or more within series as it does between series. This condition is probably due to the predominating influence of variations in organic matter content. However, in general, the heavy textured soils have a higher base exchange capacity than the light textured soils.

According to various investigators the ratio of cations to one another i.e. Ca/K and Ca/Mg, may be of greater importance in soil-plant relations than the actual total amount of the cation present. The ratios of cations to one another is presented in Table 25 although there is insufficient information to show the part these ratios play in soil-plant relationships.

The per cent saturation with calcium is more than 100 in many instances because these soils contained free carbonate that was not removed prior to determining the exchangeable bases. Hence some calcium which was not a part of the exchange complex was determined as being exchangeable.

According to the information available a relatively wide Ca/K ratio is desirable. The Ca/Mg ratios are narrow, in most cases, since the limestone from which the soils developed contains fair proportions of magnesium.

The results tabulated in Tables 24 and 25 are included in the Soil Survey Report to be used as a guide in developing a fertility concept for the area and should be interpreted in consideration of the crop grown.

TABLE 24

CHEMICAL AND PHYSICAL COMPOSITION OF SURFACE SOIL FROM PERTH COUNTY*

Soil Type	Sample No.	Location			Sand	Silt	Clay	Reaction pH Glass Electrode	(1) Phosphorus Readily Soluble Lbs. P/Acre	(2) Potassium Exchangeable Lbs. K/Acre	Magnesium Exchangeable Lbs. Mg/Acre	Calcium Exchangeable Lbs. Ca/Acre	(3) Organic Matter %C x1.724
					Bouyoucos Hydrometer								
		Township	Lot	Conc.	Per Cent 1-.05mm	Per Cent .05-.002mm	Per Cent <.002mm						
Brookston clay loam	109	Easthope S.	36	II	26.8	45.0	28.2	7.5	171	239	1,262	12,160	6.91
	25-H	Mornington	12	X	30.6	42.4	27.0	7.4	170	258	1,774	13,520	5.53
	29-H	Wallace	4	VI	28.4	48.3	23.3	7.6	102	266	2,211	14,560	9.31
Brookston silt loam	99	Downie	4	VI	29.0	57.0	14.0	7.3	67	226	1,312	8,640	6.09
	100	Ellice	12	II	31.0	58.8	10.2	6.7	200	246	1,645	10,760	11.50
	131	Ellice	15	VI	27.4	59.2	13.4	7.2	182	170	1,268	9,320	8.44
	102	Easthope N.	40	VI	27.4	54.4	18.2	6.2	232	216	2,907	9,250	8.36
Harriston silt loam	168	Hibbert	15	X	20.2	65.5	14.3	7.3	26	118	918	7,200	5.45
	169	Fullarton	30	Thomas Road	25.2	57.6	17.2	7.8	36	126	785	8,640	5.98
	1-H	Wallace	37	II	24.8	63.6	11.6	7.3	25	140	2,260	17,760	6.32
	20-H	Wallace	43	II	24.6	63.8	11.6	7.0	47	242	1,288	7,120	4.56
	22-H	Wallace	55	II	21.4	61.2	17.4	7.3	33	352	1,166	5,040	3.21
	26-H	Wallace	19	II	31.2	58.2	10.6	7.1	66	180	1,968	7,720	3.66
	27-H	Wallace	13	III	22.3	59.7	18.0	6.8	43	235	2,187	8,680	3.91
	30-H	Wallace	13	VIII	25.2	63.8	11.0	7.2	35	156	923	4,480	2.58
	4-H	Elma	7	I	32.5	57.4	11.1	7.0	34	203	2,187	6,760	3.72
	1-H	Wallace	37	II	24.8	63.6	11.6	7.3	25	140	2,260	17,760	6.32
	2-H	Elma	10	V	31.2	59.2	9.6	6.5	24	196	1,071	4,600	3.08
Huron clay loam	132	Ellice	24	III	.....	.....	.....	7.8	78	176	1,231	7,700	4.65
	135	Blanshard	27	XI	32.2	42.6	25.2	7.8	72	300	786	7,380	4.32
	133	Blanshard	14	XIV	24.8	48.6	26.6	7.8	54	392	594	14,952	4.80
	134	Blanshard	13	XIV	28.8	50.0	21.2	8.0	78	170	810	11,136	5.97
	170	Hibbert	10	IX	28.0	48.4	23.6	7.7	74	120	955	10,496	5.40
	167	Hibbert	25	X	26.2	47.0	26.6	7.9	56	220	822	10,480	4.78
	35	Hibbert	16	V	28.2	48.8	23.0	8.0	84	288	660	12,000	4.62
	108	Easthope N.	17	I	39.0	40.4	20.6	7.1	74	264	1,006	4,200	3.09
	116M	Easthope S.	28	VII	39.6	38.4	21.0	6.8	50	138	652	5,200	.....

Huron silt loam	18	Blanshard	31	XIV	27.4	54.8	17.8	7.1	92	252	931	9,500	4.52
	114	Blanshard	10	I	22.4	66.8	10.8	7.2	56	226	1,360	7,134	5.89
	112	Fullarton	6	VI	30.8	54.2	15.0	7.7	80	200	1,563	8,976	6.28
Listowel silt loam	19	Blanshard	15	IX	23.0	64.0	13.0	7.5	64	280	1,456	7,480	5.86
	136	Blanshard	13	VI	22.2	65.0	12.8	6.8	48	130	761	7,760	5.92
	113	Fullarton	12	XIII	24.4	61.2	14.4	7.0	260	98	1,162	8,516	5.55
	115	Logan	21	XIV	34.6	54.6	10.8	6.6	240	108	1,489	8,600	8.02
	8-H	Wallace	30	IV	26.4	58.8	14.8	7.1	31	133	2,624	8,480	6.33
	19-H	Wallace	43	IV	28.0	61.4	10.6	7.0	24	94	1,312	7,120	4.83
	23-H	Elma	18	II	22.4	64.2	13.4	7.5	48	180	2,236	9,320	5.57
	24-H	Elma	23	IV	23.1	60.7	16.2	7.8	58	164	1,361	9,880	8.31
	28-H	Wallace	19	VI	20.8	65.1	14.1	7.4	42	461	1,507	10,720	5.78
	3-H	Elma	4	I	27.8	59.3	12.9	7.1	27	130	3,130	4,600	3.12
	5-H	Elma	5	VI	24.2	60.6	15.2	7.1	194	133	3,085	13,320	5.36
	7-H	Elma	16	VI	30.1	55.9	14.0	7.1	24	121	2,950	4,760	3.08
	8-H	Wallace	30	IV	26 4	58.8	14.8	7.1	31	133	2,624	8,480	6.33
Muck	177	Ellice	12	X	.....	.....	.....	7.8	216	152	2,235	59,200	8.02
Parkhill silt loam	6-H	Elma	10	X	25.6	59.7	14.7	6.8	237	234	3,038	6,650	5.42
	21-H	Wallace	51	III	20.8	65.2	14.0	7.3	48	226	3,121	7,220	6.21
Perth clay loam	34	Hibbert	6	VI	28.0	49.4	22.6	7.8	64	176	.....	7,840	4.35
	180	Logan	6	VII	29.4	48.6	22.0	7.2	45	122	899	6,920	5.98
	181	Logan	6	VII	29.6	47.8	22.6	7.4	70	160	1,239	8,000	6.23
	130	Ellice	8	II	27.8	46.0	26.2	6.5	22	128	907	5,050	5.34
Perth silt loam	36	Hibbert	9	IV	19.2	57.2	23.8	7.7	164	192	1,432	9,940	5.43
	83	Downie	12	IX S.E.	27.8	57.2	15.0	7.6	56	168	1,218	8,250	5.36
	110	Downie	18	VIII	28.6	52.4	19.0	6.0	41	146	1,419	6,200	7.05
	111	Downie	16	XIII	24.6	56.8	18.6	7.1	228	300	1,419	11,540	6.81
	82	Easthope S.	42	VIII	24.4	57.6	18.0	6.2	124	144	1,981	5,400	5.89
	98	Easthope S.	30	IV	29.8	56.8	13.4	7.3	150	170	1,110	23,400	5.02
	101	Easthope S.	35	V	32.6	52.4	15.0	7.4	51	160	984	7,300	5.07

* Samples were taken during the course of the soil survey in 1936 and 1946 when the County was surveyed. Old pastures representative of the type were selected whenever possible Analyses were done by Dr. A. L. Willis. and Messrs. H. S. Ive, E. F. Bolton and D. W. Hoffman.

(1) Lohse and Ruhnke's method of determining readily soluble phosphorus was employed. For discussion of this method see Lohse, H. W. and Ruhnke, G. N., "Studies of Readily Soluble Phosphorus in Soils" — Soil Science 35:6, 1933. Lohse and Ruhnke state that "it has been the experience of this institution (Ontario Agricultural College) that soils containing less than 30 mgm. of P per 1,000 gms. of soil (60 lbs./acre) appear to indicate very marked phosphate deficiency."

(2) Method for determining exchangeable potassium magnesium and calcium proposed by Schollenberger, C. F. and Simon, R. H., "Determination of Exchange Capacity and Exchangeable Bases in Soil, Ammonium Acetate Method." Soil Sc. 59:1, 1945.

(3) The organic carbon was determined by the chromic acid method described by Allison, L. E., "Organic Soil Carbon by Reduction of Chromic Acid" — Soil Science Oct., 1935 p. 311. The organic matter data was obtained by applying the factor 1.724 to the per cent of organic carbon.

TABLE 25

BASE EXCHANGE CAPACITY* AND PER CENT SATURATION OF SURFACE SOIL FROM PERTH COUNTY, ONTARIO

Soil Type	Sample No.	Base Exchange Capacity M.E./100 gms	Per Cent Saturation				Ratios	
			† H+	Ca++	Mg++	K+	Ca:K	Ca:Mg
Brookston clay loam	109	31.82	.....	95.5	16.3	0.9	99.6:1	5.8:1
	25-H	28.85	.....	117.0	25.3	1.1	101.7:1	4.6:1
	29-H	38.39	.....	94.9	23.7	0.8	106.6:1	4.0:1
Brookston silt loam	99	24.62	.....	87.8	21.9	1.1	74.8:1	4.0:1
	100	33.75	.....	79.7	19.8	0.9	85.5:1	4.0:1
	131	27.60	.....	84.2	18.8	0.7	107.2:1	4.4:1
	102	30.56	.....	75.6	38.9	0.9	83.7:1	1.9:1
Harriston silt loam	168	22.72	3.9	79.3	16.2	0.6	120.0:1	4.8:1
	169	21.30	.....	101.2	15.0	0.7	134.1:1	6.7:1
	20-H	13.00	.....	136.6	40.7	2.4	56.6:1	3.3:1
	22-H	11.90	.....	115.8	40.3	3.8	27.8:1	2.6:1
	26-H	15.18	.....	127.6	53.6	1.5	82.7:1	2.3:1
	27-H	19.67	.....	110.2	45.8	1.5	72.0:1	2.4:1
	30-H	9.48	.....	118.1	40.2	2.1	56.0:1	2.9:1
	2-H	16.32	.....	103.9	55.2	1.5	66.0:1	1.8:1
Huron clay loam	132	19.71	.....	97.5	25.4	1.1	85.2:1	3.8:1
	135	17.67	.....	105.5	18.1	2.1	48.8:1	5.8:1
	133	17.79	.....	209.0	13.5	2.8	74.5:1	15.5:1
	134	22.48	.....	123.7	14.7	0.9	127.8:1	8.4:1
	170	21.50	.....	121.8	18.1	0.7	171.2:1	6.7:1
	167	18.70	.....	140.2	17.6	1.5	93.1:1	7.9:1
	35	18.84	.....	159.2	14.3	1.9	81.6:1	11.1:1
	108	12.83	.....	81.9	32.0	2.6	31.2:1	2.5:1
	116M	15.14	.....	86.0	17.8	1.1	73.8:1	4.8:1
Huron silt loam	18	18.23	.....	129.9	20.8	1.7	73.6:1	6.2:1
	114	20.33	.....	82.5	27.6	1.4	61.7:1	3.1:1
	112	25.62	.....	87.3	25.0	0.9	87.2:1	3.5:1
Listowel silt loam	19	22.36	.....	83.7	26.4	1.6	52.2:1	3.1:1
	136	24.41	7.3	79.5	12.6	0.6	116.2:1	6.2:1
	113	23.58	.....	89.8	19.9	0.5	169.2:1	4.5:1
	115	26.53	.....	80.9	22.9	0.5	155.7:1	3.5:1
	8-H	23.80	.....	88.9	45.3	0.7	124.3:1	1.9:1
	19-H	16.11	.....	110.5	33.5	0.7	147.9:1	3.3:1
	23-H	22.55	.....	103.1	40.7	1.0	100.8:1	2.5:1
	24-H	25.30	.....	97.7	22.2	0.8	118.0:1	4.4:1
	28-H	23.57	.....	113.7	26.3	0.8	140.3:1	4.3:1
Perth clay loam	180	20.63	.....	83.9	17.9	0.7	111.0:1	4.6:1
	181	24.28	.....	82.3	20.0	0.8	97.7:1	3.9:1
	130	18.15	9.3	69.4	20.4	0.9	77.2:1	3.4:1
Perth silt loam	36	19.00	.....	130.6	30.5	1.2	101.0:1	4.2:1
	83	23.22	.....	88.8	21.5	0.9	96.2:1	4.1:1
	110	24.17	11.2	64.1	24.0	0.7	82.0:1	2.6:1
	111	33.34	.....	86.6	17.4	1.1	75.2:1	4.9:1
	82	21.33	.....	63.2	38.1	0.8	73.3:1	1.6:1
	98	14.57	.....	402.5	31.0	1.4	269.4:1	13.0:1
	101	19.81	.....	92.0	20.2	1.0	89.0:1	4.5:1
Muck	177	48.10	.....	255.8	19.3	0.4	631.3:1	13.3:1

* Method proposed by Schollenberger, C. F. and Simon, R. H. "Determination of Exchange Capacity and Exchangeable Bases in Soil, Ammonium Acetate Method." Soil Science 59:1, 1945. The alternate method was used on Perth County soils in which the soil is leached with 1NKCl.

† By difference.

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